SCIENCE DIGEST

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MAN vs SKIS

12 most common injuries and how to avoid them

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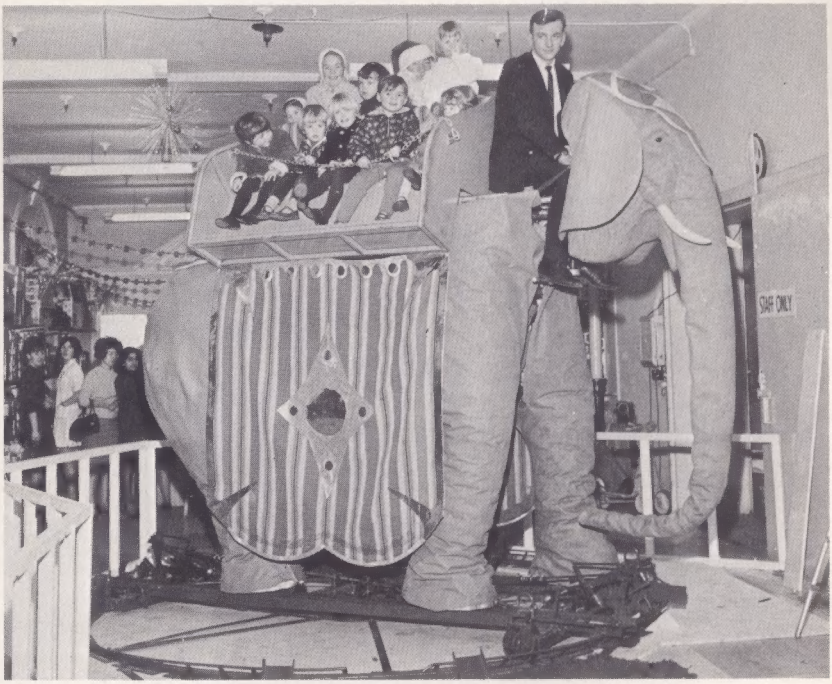

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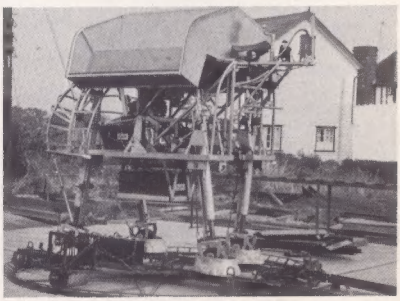

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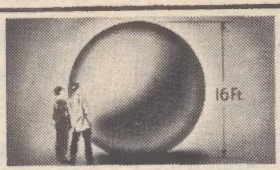

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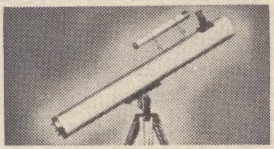

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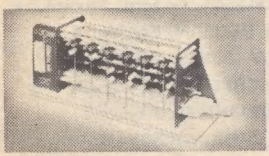

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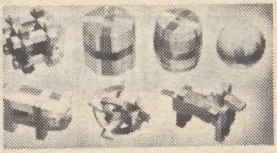

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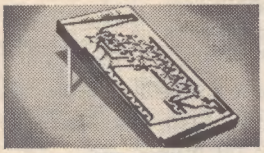

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IF you don't get a chance to visit Britain's Stonehenge, described in the story beginning on page 16, but still like to explore mysterious old ruins, you could do worse than pay a visit to the place that is called (a bit grandly perhaps) "America's Stonehenge." It's better known as "Mystery Hill," and it is located near the little town of North Salem, N. H. Mystery Hill doesn't look much like Stonehenge, and it is nowhere near as large, but clearly someone spent a lot of time building

THIS MONTH

stone caves and walls which served no apparent purpose. Professional archaeologists have never been able to find anything that indicates that Mystery Hill was built before Colonial times. The conservative view is that the caves were built by Jonathan Patee, the farmer who owned the land from 1835 to 1855. But more adventurous thinkers have seen the place as the home of Irish Monks, Viking colonizers or Phoenician sailors, all of whom had come to the New World long before 1492. Present owners of the site are pushing the idea that it was built by the same sort of people who built Stonehenge. Individuals interested in Mystery Hill have organized the New England Antiquities Research Association (NEARA), and have been energetically searching out other examples of megalithic construction in the United States. —*D.C.*

news, knowledge, advice

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During the past ten years skiing has grown into a vast national, wintertime obsession. It can be great fun, and it needn't be hazardous with the expert advice on how to avoid the most common ski injuries that begins on page 7.

Photo: Michigan Tourist Council

DIGEST

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Bulletins at press time

U.P.I.

'CRUEL' VENUS. The Soviet capsule above parachuted to the surface of the planet Venus confirmed reports sent back by an earlier U. S. Venus probe, that the planet was too hot to support life as we know it. Atmospheric temperatures of 104 to 536 degrees Farhenheit were recorded. Preliminary Soviet findings also indicated that the planet's atmosphere consisted almost entirely of carbon dioxide. The atmosphere was about 15 times as dense as earth's.

SPACE RACE SCORE. Although there was some doubt as to whether the Soviet capsule accomplished as much as claimed, U.S. scientists were unanimous in their praise of the Russian achievement. The U.S. was not planning a similar feat until at least 1972. Mariner 5 flew by Venus shortly after the Russian probe had landed.

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BRAIN TRANSPLANTS. Successful transplants of brains from one animal to another with survival periods of three days without any suggestion of immunological rejection were achieved by three scientists at the Western Reserve U. School of Medicine. Sought are insights into what happens during consciousness, intellectual activity and remembering during anesthesia and during various forms of brain failure.

WATCH OUT FOR ASTEROIDS. Dr. Harold Masursky, an expert on the moon said that most scientists are convinced that the large craters on the moon were formed by collisions with other heavenly bodies. Dr. Masursky thinks that man should pay more attention to this potential natural hazard. "Man acts as if he were in complete control of his environment, but he is not," the geologist said. Biggest danger, he feels, is from asteroids. "Only 30 small astronomical bodies are being monitored at the present time," he said. "We could increase this by many orders of magnitude. Many of these are coming very, very, very close to earth." The asteroid Icarus, would hit if its orbit changed by only one degree.

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C.	Total Paid Circulation	151,008	148,944
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JOHN R. MILLER, General Manager

How to avoid the

12 MOST COMMON SKIING ACCIDENTS

by Kenneth N. Anderson

A gray-haired grandmother from Sacramento recently made her first weekend ski trip of the season to a lodge in the Sierras. After a few practice runs on a lower slope, she rode a chairlift to the top of the big run, paused momentarily to study the powdery surface in the flat light, then schuss-boomed straight down the hill and into a mogul built up by scores of previous skiers.

Before the woman could pick herself up, a burly Samaritan of the Ski Patrol was at her side. He made a quick check of her condition and signalled for a toboggan. "Please don't. I'm all right. I can make it on my own," the woman insisted.

Now a second Ski Patrol member was on the scene and helped convince the woman they would take her to the medical station by a back trail. The physician on duty found the woman had suffered sprained ankle ligaments and a chipped bone, in addition to numerous bruises. The grandmother later sent a note to the Ski Patrol thanking the men for not permitting her to continue the trip to the bottom of the hill under her own power. Although minor and quick to heal, the injuries could have been seriously aggravated if she had done any further skiing that day.

The grandmother, while no novice, had nevertheless made several mistakes common to the start of the season. First, she had plunged into a difficult test of ability with a minimum of practice. Also, she had forgotten to take into consideration the visual tricks played by the light reflected on an overcast day. Such light flattens the physical features, obscuring bumps and depressions in the snow. While an experienced skier can negotiate a mogul, or snow bump, without difficulty, he must be able to see it in his path and be in control of his speed.

The woman was saved from one common mistake: skier's vanity. A sportsman who considers himself adept is embarrassed by a fall and frequently tries to salvage his self-esteem by continuing even though he may be more seriously hurt than he thinks he is. This can be as foolish as trying to walk away from a head-on auto collision just to prove to bystanders that you "can take it." The Ski Patrol usually is aware of this human failing and when feasible will find a way to remove a fallen skier to safety by a trail out of sight of other skiers.

United Press International

Colles' fracture of wrist, shown in X-ray at left, occurs when skier is thrown headfirst towards ground and instinctively tries to break the fall with his hands. The force exerted at the extended wrist causes breaks in the radius and ulna.

Actually skiing is not as dangerous as many other action sports, such as football, boxing or hockey. According to Dr. James G. Garrick of the Mayo Clinic and a former resident physician at Vail, Colo., "The ski injury is rarely, if ever, a life-and-death situation." A study reported by *Today's Health,* published by the American Medical Association, shows the chances of being injured during a full day on a slope are about one in 200. Yet, 12,000 skiers this season will wind up in a doctor's office with major or minor injuries sustained on the slopes.

What are the most common causes of accidents among skiers? The National Ski Patrol, whose more than 10,000 members promote ski safety on most of the country's slopes, has found that about 70 percent of ski accidents result from the skier's loss of control. He may "lose it" when his speed exceeds his abilities; because he is not familiar with the terrain; when he does not know the snow condition, which can vary from powder to slush to ice; or because he does not observe changing weather conditions which affect the snow surface. Trying to maintain balance on a couple of strips of wood while schuss-booming through the pine trees at 50 mph can be the most thrilling experience of your life—as long as you are in control of the situation.

About eight percent of ski injuries are the result of collisions between skiers, or with rocks, trees or bare spots. Another eight percent are due to faulty ski equipment, and an equal number result from accidents on ski tow equipment. The remainder are due to such things as poor visibility and improper maintenance of ski runs.

A study by the National Ski Safety Research Project, headquartered at Rochester, Minn., reveals that about half the ski injuries occur during an individual's first two hours of skiing. The study also indicates that although a third of the injuries happen between 2:30 and 4 p.m., this is the period of the day during which there are more skiers on the slopes. Although the high rate of late afternoon accidents has been attributed to fatigue, the study director, Dr. Garrick, says this is a common misconception. The real reason is that there are more people skiing at that time of the day.

The most frequent force encountered in a ski accident is the outward rotation of the leg, according to Dr. Arthur E. Ellison of the Mount Snow Medical Center in Vermont. The inside edge of a ski catches and is immobilized in the snow. The foot is locked in the boot, which is attached to the ski, and the force of rotation is dissipated on the leg. The result is torn ligaments or broken bones.

Dr. Milton Wolf, ski physician at Mount Snow, has listed the following as among the most common injuries:

1. *Boot-top fracture* of the tibia and fibula (the two long bones of the lower part of the leg). This injury occurs as a result of a fall on wet snow, particularly if the skier has been moving at high speed. The ski may jam against an obstruction, but the weight of the body continues its forward motion, snapping the bones.

2. *Rupture of the Achilles tendon.* This is also an injury associ-

Spiral fractures of the tibia and fibula, shown in X-ray at right, result when the skier falls with his legs under his body as pictured below. The weight of the body dropping on a buckled leg produces enough force to break the lower leg.

ALPHA

United Press International

Boot-top fractures of the tibia and fibula, long bones of lower leg, usually occur because of fall on wet snow, especially at high speed. The ski may jam against obstruction, but the knee continues its forward motion, and the bones snap.

ated with speeding on wet snow. The tendon which attaches the calf muscles to the heel bone may be torn by the forward motion of the body when one ski suddenly jams. Examination of the injury may show a hollow area above the heel and the skier will be unable to stand on his toes.

Although the new release bindings are supposed to reduce such injuries, Dr. A. Scott Earle of the Sun Valley, Idaho, medical department, told a recent University of Wisconsin conference on winter sports injuries that Achilles tendon ruptures occur just as frequently

with release bindings as they did before the introduction of the safety device.

3. *Anterior dislocation of the shoulder.* According to Dr. Wolf, this type of injury can be expected in January and February when there is little snow on the ground. It is an impact injury which can result when the skier is thrown off balance and topples headfirst toward the ground.

4. *Fractured clavicle,* or collar bone. Like the shoulder dislocation, this type of accident is associated with cold temperatures and lack of snow on the ground.

5. *Colles' fracture of the wrist.* This injury also occurs when the skier is thrown headfirst toward the ground and extends an arm to break the fall. The force exerted at the top of the extended wrist may fracture the radius and ulna (two long bones of the forearm).

6. *Ski pole fracture.* This is not an injury to the ski pole! It is a type of accident reported by some doctors and is intended to describe broken bones in the hand which occur when a skier falls on a hard surface with the arm extended and the ski pole clasped in his hand.

7. *Dislocated thumb.* This is another ski pole hazard which occurs when the skier falls with the strap of the ski pole twisted around the thumb.

8. *Coccygeal fracture.* This polite medical terminology refers to a broken tail bone or fracture of the vertebrae at the very bottom of the spinal column, just beyond the sacrum. This is another impact injury of the sort most likely to occur in cold weather when there is little snow on the ground.

9. *Fracture of the femoral neck.* The thigh bone, or femur, joins the hip bone, and this is the part of the upper femur where it forms a nearly right angle to fit into the ball-and-socket joint with the hip bone. The neck of the femur may break from the force exerted during a spill when a ski hits a bare spot.

10. *Spiral fractures* of the tibia and fibula. This injury is the not uncommon result of a skier falling with his legs under his body. The weight of the body dropping on a buckled leg produces a force that breaks the bones of the lower leg. X-rays show a dark spiral line where the fracture occurred. Similar damage may result from a mishap in which a lateral force is lodged against the inner side of the leg.

11. *Ankle injuries.* These are among the most common threats to skiers and are most likely to occur in warm weather when the snow is deep. A sprain may be associated with a fracture of one of the bones in the ankle. One ligament frequently involved is the deltoid, which connects the end of the tibia (one of the long bones of the lower leg) to the talus (one of the foot bones directly beneath the leg). The talus may be dislocated by the twisting effect on the ankle that can be expected when skiing in deep snow.

12. *Twisted knee.* Some ski phy-

sicians report that 25 percent of all injuries on the slopes involve the knee. The mishap may be a simple bumped knee, a displaced knee cap, or a case of torn ligaments. A twisted knee frequently occurs on the same leg as an ankle injury, and doctors who treat skiers for knee injuries usually check the ankle for bone or tissue damage.

The question of whether pre-season physical conditioning helps to prevent ski injuries has not been resolved. William C. Sears, assistant director of the National Ski Safety Research Project and former professional ski patrolman at Vail, told the University of Wisconsin conference that physical conditioning benefits have been assumed but not proved. He recommends warm-up exercises before skiing. Dr. Garrick suggests that some pre-season conditioning exercises, such as deep knee bends, actually may predispose a skier to injury. The knee bends may add to the instability of the knee by stretching the ligaments.

Dr. Ellison also doubts that physical conditioning is an important factor in preventing injuries. He points out that a National Ski Patrol survey revealed the average skier spends only two days a year on the ski slopes, never learns to ski properly and does little to keep his ski equipment in proper condition. He adds that, in his opinion, too many skiers pay more attention to "finding playmates and having a ball" than learning how to ski safely and correctly.

Skiing safety tips from the AMA

WHAT advice do ski slope physicians give for prevention of ski injuries?

• Experts report that most accidents are caused by the skier's poor physical conditioning and over-confidence. What can you do to condition yourself?

a. Exercise regularly with half knee-bends, toe-walking, toe-touching and push-ups.

b. For thigh muscles, sit on a table edge, lift legs and straighten them slowly. Repeat. Add weights and repeat until you're up to 35 pounds.

• Do a little warm-up exercising before take-off to loosen joints.

• Avoid expert trails when you're tired, and until you've had a few practice runs on lower slopes.

• Make sure all your equipment is properly adjusted and secured.

• Use the best safety release bindings you can find. Test them for tension and make sure your foot snaps out before you feel undue pressure. This should be done at the lodge.

• Never ski alone. If you're hurt, a buddy can go for help.

• Learn to "check" speed properly before you tackle the expert trails.

• Take the run slowly before you schuss it and spot moguls and bare places—especially on overcast days.

• *DON'T* try to get up and "coast" home after a bad fall. Call for help.

Though small enough to hold in one's hand, this unusual looking creature, a tenrec, is by no means gentle to the touch. Its body is covered with small quills, which it rubs together to make noise or to communicate—scientists are still not sure just which.

"The most unappetizing beast imaginable"

AFTER an abortive attempt to investigate a rat-size, shrew-like animal they called "the most unappetizing beast imaginable," two psychologists at Princeton University remain uncertain as to whether the tenrec possesses a communications system unique among mammals.

Some 20 of the animals were sent almost two years ago to Princeton's Auditory Research Laboratory by Dr. Edwin Gould, a young researcher at Johns Hopkins University. Dr. Gould had collected them during an expedition to the island of Madagascar, off the coast of Africa.

The tenrec is thought to be the only mammal to possess the ability to "stridulate"—that is, to produce noise, as a cricket does, by rubbing two parts of its body together. The tenrec's stridulatory organ consists of a group of small quills located on its back, which may be rubbed together to produce strong, high-frequency sound.

The director of the Auditory Research Laboratory, Dr. Ernest Glen Wever, was interested in the theory, so far unsupported by evidence, that the tenrecs somehow make use of their stridulating ability to communicate with each other. In his attempts to test this possibility he was aided by postdoctoral fellow

Dr. Paul N. Herman.

Tenrecs are natives only to the island of Madagascar, where several species live in abundant numbers. A social animal, the species studied at Princeton normally spends its life in bands scouring the rainforest floor at night, poking its long, pointed nose under leaves in search of worms and insects. One theory is that the animals use their high-frequency stridulating ability to keep together in the darkness, out of earshot of other animals and natives, who are said to find them appetizing.

Another theory is that they may use their frequencies, as bats do, in echolocation, the radar-like bouncing of sound off objects to determine their location.

A mass of furs and quills

A little smaller in size than a rat, the tenrec has black and white fur and sharp, pointed quills over its neck and back. When annoyed, it is capable of extremely fast movements with its quills extended, making handling difficult, as the researchers quickly found.

Buried beneath the fur and quills about midway down the tenrec's back is a group of some nine or more shorter, stubby quills, which the animal can rub together to produce very strong vibrations of extremely high frequency—ranging from 25-40,000 cycles per second, which Dr. Wever was able to measure. Since the human ear can hear from some 35-20,000 cycles per second at best, the tenrecs' stridulations are far beyond the range of human hearing.

After they measured the range of vibrations, the experimenters' next task was to determine if the animals themselves could detect the sounds they were producing. This involved a technique developed at Princeton under Dr. Wever's direction and used with all kinds of animals: the cochlear potential technique. By applying an electrode at a point in the inner ear where the animal converts sound vibrations to the electrical signals that will go to the brain—in the round window of the cochlea—the scientists can "monitor" the sound that actually goes to the brain of the animal under study.

But because the tenrec colony at Princeton met a series of unfortunate incidents, the two scientists were able to study only one animal's hearing in detail. The results gave evidence that the animal was in fact able to hear all but the highest-frequency stridulations, though probably not as effectively as it could hear lower frequencies. Whether the animals used any kind of "code" or "language" in their stridulations could not be investigated, due to the following incidents.

First, a short-lived power failure in the early spring of 1966 cut off the heat in the building housing the tenrecs, taking the lives of three of the tropical animals. Dr. Wever suspects that one of the fatalities must have been the leader of the pack, because shortly after the first

A gourmet's delight for the tenrec is a plentiful supply (40 or 50 a day) of live earthworms.

misfortune, uncontrollable fighting —to establish a new pecking order, Dr. Wever assumes—broke out. Before it ended, all but five of the remaining animals had succumbed.

Next, because there was virtually no information about the laboratory behavior or the anatomy of the animals, difficulty in administering anesthesia and in locating the proper site for application of the electrode took the lives of four of the remaining five animals. Thus the population dwindled before experiments on the possibility of a novel communications system could be studied extensively.

The Princeton researchers look back on their tenrec studies with little nostalgia. Dr. Herman, who assisted in the surgery for the electrode applications, called them "a uniquely frustrating laboratory animal." Unlike any other animal ever studied here, he said, the tenrec was found to possess a small barrier almost directly over the spot of the electrode application, making the surgical procedure almost impossible. Too, the sharp spines, combined with the animals' complete fearlessness and abundant lice colonies, made handling unattractive under any circumstances.

The workers at the laboratory, moreover, still talk about the "fantastic" odor generated by the tenrec family, and the animals' unusual eating habits. After much variation of diets, they found that the only nourishment the tenrecs would take in captivity was live earthworms—up to 40 or 50 per animal per day. The researchers nearly exhausted the local supply, and eventually began to contemplate air shipments—a highly expensive proposition, they found.

They were spared this last step, however, when the power failure and subsequent fighting reduced the local "worm drain."

Educational dropouts

Another drawback was the tenrecs' failure to cooperate with experimenters in behavioral studies. Usually, to test an animal's ability to, say, hear a certain sound, it is taught to make some response—a movement, perhaps—when the sound occurs, either in pursuit of a reward, such as food, or to escape or avoid punishment. But as researchers at Johns Hopkins had found previously, the tenrecs just ignored experimental situations that involved food as an incentive. They never bothered, despite their voracious appetites when fed.

At Princeton, Dr. Herman tried, with a similar lack of success, to teach one animal to avoid a mild electric shock—a task easily learned by goldfish, pigeons, cats, rats and a host of other animals. But the tenrec "simply showed no inclination to learn," he said.

Photos by Bridgit Smith

Stonehenge today is a formidable tourist attraction. But the milling crowds do not entirely destroy the sense of mystery and wonder that hang over the ancient monument. No visitor fails to ask himself the question, "How was this all built and why?"

The stones of Wiltshire

Stonehenge is only one of the great prehistoric monuments that dot southern England. Some others are bigger and even more mysterious.

by Daniel Cohen

WHEN you enter Stonehenge for the first time it's bound to be a little disappointing. The thing is not quite as big as you had imagined, and it's jammed with tourists. Children chase one another wildly around the standing stones, and scamper over the fallen ones. Photographers bump into you while backing off to get the proper angle for a snapshot of mum and the kids in front of the sarsen trilithon. It's hard to get a feeling of antiquity under such conditions.

But if you stand around for a while looking at those stones, your feelings begin to change, and the spell of Stonehenge takes hold. You can forget all the people around, and the highway that runs just a few feet away. You begin to imagine yourself as one of the Neolithic beaker folk, the name archaeologists have given to the people who inhabited the chalk downs of Britain around 1500 B.C. when Stonehenge was being built. Then quite suddenly, the stones seem enormous!

How did people, equipped with only the simplest of tools, fashion and erect this monstrous edifice; more importantly why did they do it?

The feats are even more impressive and puzzling when you realize that Stonehenge is just one,

although the most famous, of a group of prehistoric monuments in the same general area. Clearly, what is today the county of Wiltshire was, in prehistoric times, the center of a large, thriving, and as yet, little understood culture.

Next to Stonehenge, the most impressive of the Wiltshire monuments is the great stone circle at Avebury. In many ways it is even more impressive. Every visitor knows what Stonehenge looks like before he arrives, but lesser known Avebury comes as a surprise, even a shock.

You are driving along a quiet country road, when suddenly there is a huge stone shaped roughly like a diamond and standing on end stuck along the side of the road. A little farther along there is another, and another; a whole avenue of great stones. The road leads through a high bank of earth and inside there are more stones. At first no pattern can be determined.

The road takes you right into the little village of Avebury, and only after you park your car and walk around a bit, do you realize that the village is almost entirely surrounded by a double bank of earth and a circle of stones nearly a third of a mile across, with additional stones scattered inside the larger circle.

There is something freakish-looking about the Avebury stones. At Stonehenge the rock has been, in most cases, worked smooth. But at Avebury the stones are natural, except for their wildly unnatural placement. They look as though they had been stuck into the ground by some simple-minded giant. Sheep graze their way up and down the ancient earth banks, and have worn the base of some of the great stones smooth, scratching their woolly backs on them. Therein lies the real charm of Avebury—the contrast between the pastoral present and ancient times when, in the imagination at least, all manner of wild rites may have taken place inside the stone circle.

Another nice thing about Avebury is that you can have it almost all to yourself. As you walk the ridge along the top of the bank, you may meet one or two other visitors, but the place is so large you hardly notice them.

Top: The stones of Avebury. Part of the village can be seen in the background. In the foreground is a concrete post erected to mark position of a missing stone. **Center: Silbury Hill** as seen from the West Kennet Long Barrow. Visitors can walk to the top of the hill via a narrow path. **Bottom: Entrance to the Long Barrow.** Visitors can enter the now empty chambered tomb. Some thirty skeletons have been removed by archaeologists.

If you really want to be alone with something ancient, go a short distance from Avebury to the West Kennet Long Barrow. After you park your car you have to walk a long distance on a narrow path, enclosed on both sides by barbed wire. The path from the road to the Long Barrow runs right through a cultivated field, and you are not quite sure whether the barbed wire is meant to keep the cows off the path or the people out of the field.

The barrow is a chambered tomb; the largest in England. The mound, measuring 350 feet in length, is made up of chalk rubble dug from a ditch on either side and piled over a chamber of boulders collected from the surrounding area. The front of the mound has a facade of large upright stones. There is no doubt that the barrow was used as a tomb. Some 30 skeletons have been removed from it. The Long Barrow dates from about 2000 B.C., making it one of the earliest large monuments in the area. Archaeologists think it was used and re-used for 300 years.

From the Long Barrow you can get a good look at one of the latest of the prehistoric monuments of the area, built somewhere around 1400 B.C. This is Silbury Hill, the largest artificial mound in Europe. The mound is conical in shape and is some 135 feet high. The base covers five-and-a-half acres. It consists of chalk rubble excavated from a huge ditch at the base. Today the ditch is almost entirely silted up.

The purpose of Silbury Hill remains a mystery. In 1777 a shaft was sunk from the top to the undisturbed chalk in the middle of the mound. Later, a tunnel was burrowed in to meet the shaft. In neither case were any significant artifacts found. Says R.J.C. Atkinson, professor of archaeology, University College, Cardiff, "It should perhaps be regarded as the largest of all round barrows, and it may be roughly of the same date as the stones of Stonehenge. All that we can be certain of is that it is earlier than the building of the Roman road from Bath to Marlborough, which is aligned on the mound but swerves to avoid its base."

About two miles northeast of Stonehenge the early peoples of Britain built another circular monument, similar in shape to Stonehenge, although much smaller. Here, however, the builders used wood, and all obvious traces of this "Woodhenge" had decayed centuries ago. It was rediscovered by aerial photographs, and excavated in 1928. Excavators found the familiar bank and ditch, although here the boundary had been almost completely flattened by ploughing. There were six concentric rings of circular holes for wooden posts and, in some cases, the rotted stumps of the posts still survived below ground. Prof. Atkinson states, "Since nothing survived above ground, we can only guess what the remains represent. The most sensible explanation is that the posts formed the upright framework of a roofed building, like a huge barn bent round upon itself into a circle, leaving a space open to the sky in the center."

Today the sites of the original posts are marked by concrete blocks.

The Stonehenge-Avebury area is littered with barrows of various shapes and sizes and other types of prehistoric earthwork. The monuments of Wiltshire are among the largest and finest prehistoric engineering works in the world. However, we know virtually nothing about how they were built. But the scholars have been able to make some good educated guesses.

Prof. Atkinson says, "The earthworks, large and small, all seem to have been built with the simplest tools. The chalk was loosened with 'picks' made from the antlers of red deer, many of which have been found abandoned at the bottoms of ditches." The broken chalk would be raked up with rakes made from antlers, and put in baskets with shovels made from the shoulder blades of oxen.

Modern experiments with copies of ancient tools have shown that two men, working in turns, can dig about four cubic yards of chalk a day. On the basis of this experiment the archaeologists figured it would take 200 men nine years to build the earthworks around Avebury. The pile of Silbury Hill would contain nearly 50 million 30-pound baskets of chalk.

Of all the building feats, how-

Some of the massive stones of Stonehenge show how smoothly ancient craftsmen were able to work stone with crude tools. Knob at top of large stone fitted into hole carved in bottom of now fallen lintel.

The "bronze axheads" here were found carved into the stones of Stonehenge in 1953. Archaeologists believe these indicate contact between Stonehenge builders and peoples from distant, civilized nations.

ever, Stonehenge represents the most sophisticated accomplishment. Some of the stones were quarried in Wales, and transported 240 miles, probably most of the way by water. The largest of the stones did not come from so great a distance, but they still had to be hauled overland for some 20 miles. Prof. Atkinson estimates that moving these great stones with crude ropes and rollers may have occupied a thousand men for several years.

Raising the stones, and particularly the lintels that cap the huge uprights, must have been accomplished by simple but painstaking methods, involving mainly the lavish expenditure of man hours and human muscle power.

The most intriguing question remains; why were the monuments built? The barrows, as noted, were graves; it has even been speculated that Silbury Hill might be a gigantic barrow for a powerful chieftain.

Some of the earthworks probably represent paths or processional ways; others the sites of camps of one sort or another. At a place called Windmill Hill, about half a mile northwest of Avebury, there is an earthwork enclosure (now barely visible, but its remains have been traced archaeologically) called the "Causewayed Camp". No permanent settlements were found inside the enclosure, but traces of campfires, broken pottery and other signs of human habitation are common just outside the earth bank. This has led archaeologists to be-

lieve that the "Causewayed Camp" was used as a cattle enclosure, into which the stock was herded in autumn. The herdsmen sat around their fires outside.

It is the stone circles, most particularly Stonehenge, however, that really excite the imagination.

Practically everyone agrees that Stonehenge was some sort of temple. The reason for such wide agreement is that everyone felt the structure had no discernible practical use, and therefore must have been dedicated to the gods.

In the last few years, however, the American astronomer Gerald H. Hawkins has advanced a theory that Stonehenge had a very practical earthly use. With the aid of a computer Hawkins found that all the important stones in the monument align with at least one other to point to some extreme position of the sun and moon. Hawkins also postulated that a group of 56 mysterious holes that lie within the monument may actually have been used as an "eclipse predictor." All in all, Hawkins found, Stonehenge was a sophisticated and brilliantly conceived astronomical observatory, used by different people over a 400 year period beginning 1900 B.C.

Hawkins was not the first to suggest the astronomical alignments at Stonehenge. For years a little cult called the Druids (their relationship to the Druidic priests of pre-Roman Britain is doubtless fictional) have been trooping to Stonehenge to celebrate the sunrise on Midsummer Day, the longest day of the year. On that day the sun rises fairly near the Heel Stone, a large rough stone which stands at the entrance of the avenue leading into Stonehenge. The people who built Stonehenge may have been sun worshippers, and some sort of Midsummer Day ritual may have been conducted there. But this cannot be proved for certain. Hawkins himself warns of "the dangers of overspeculation" and playing "the numbers game." "There are a great many numbers and alignments at Stonehenge and numbers and lines never cease to fascinate people."

A final Stonehenge mystery was discovered in 1953. Carvings of what appear to be bronze axheads and a bronze dagger were found on one of the stones. The axheads resemble a type made in Ireland around the time Stonehenge was being built. But, says Prof. Atkinson, "the best match for the dagger comes from the Shaft Graves of Mycenae in southern Greece, the legendary home of Agamemnon."

According to Prof. Atkinson, connections between prehistoric Britain and the civilized Mediterranian world had already been suspected, but this discovery provided "dramatic confirmation."

Many mysteries about Stonehenge and the other monuments of Wiltshire remain. This much, however, is certain: the prehistoric people who built them were no mere club-wielding savages. They were a well organized, technically sophisticated, perhaps cosmopolitan society.

GEOLOGY

The Red Sea's treasure

"One of the richest deposits of minerals" may lie at the bottom of the Red Sea—and with it a future hope for the Middle East.

by William J. Perkinson

THREE little-known and still mysterious "hot spots" on the unexplored, unchartered floor of the Red Sea offer substantial long-range promise of helping to solve some of the problems of the Middle East.

Those hot spots in the Red Sea, scientists of many nations now believe, indicate the location of what is thought to be "one of the richest deposits of minerals in the world."

The deposits include "abnormally high" concentrates of heavy metals such as iron, zinc, silver and gold.

The location of the Red Sea treasure is well-known to the world's scientists and economic geologists as a result of basic research carried out by oceanographers of Sweden, Great Britain, the United States, France and other nations.

The minerals are centered around a 100-mile-long area in the deepest parts of the Red Sea, some 6-7,000 feet below the surface, just above Latitude 21 degrees, 20 minutes north and just east of Longitude 38 degrees, 5 minutes east.

That would place the mineral deposits almost in the middle of the Red Sea about midway between Port Sudan, on the western shore, and Jiddah, the Arabian port on the eastern shore that serves as "The Gateway to Mecca," the most holy of all cities to millions of Mohammedans throughout Africa, Asia and other parts of the world.

The treasure also lies almost midway between the tip of the Sinai Peninsula in the north—where the Red Sea splits into the Gulf of Aqaba and the Gulf of Suez, the southern exit and entrance to the now blocked Suez Canal—and Bab El Mandeb, the strait that marks the southern entrance to the Red Sea.

It is an extremely narrow strait, about 20 miles wide, and split into two narrow shipping channels by an island known as Barin or Perim.

The channels and the approaches to the channels can be easily commanded by the guns of such nations and protectorates as Somalia, French Somalia, Ethiopia, Yemen and the soon-to-be-independent Protectorate of Aden.

The fact that five under-developed nations control the southern access to the treasures of the Red Sea, and that five other of the poorer nations—the Sudan, Egypt, Saudi

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Arabia, Israel and Jordan—control or have historic interests in other approaches to the mineral deposits on the floor of the Red Sea, is probably the chief reason why no nation has made any attempt at commercial exploration.

No company or consortium of companies was willing to risk the hundreds of millions of dollars that would be needed to mine and process the minerals on the floor of the Red Sea because of the uncertainty of conflicting international claims and counter-claims that might be made as to the ownership of the Red Sea floor.

Then, too, experts say, until recently—when such firms as Westinghouse and General Dynamics began developing "blue collar submarines" and diving gear that allows construction workers to remain for hours beneath the sea—there was no economical way of bringing the minerals up from the 6,000-foot depths.

Now, however, the picture is rapidly changing. The experts expect that men will begin exploiting these treasures within the next 10 years—if not earlier—and the exploitation is expected to do a great deal to help overcome some of the problems associated with the poverty of the entire Afro-Asian world.

It should lead not only to new ports and new cities along the Red Sea, but also to construction of "a new Suez Canal" that could handle both the super-tankers and the super-ore carriers that are now beginning to ply the world's trade lanes.

The present Suez Canal is too shallow and too narrow to handle the commercial ships now coming off the ways of many nations.

Among least explored

Even though some 20-30,000 ships of various sizes sail through the Red Sea each year, that sea, larger than the State of California, is still one of the least explored seas of the world.

The reason is quite simple. The Red Sea is a short cut to the market places of Africa, Europe and Asia. By using the Suez Canal, shipowners can save up to 6,000 miles on a single one-way voyage. Therefore, the idea has mainly been to get through the Red Sea and its treacherous channels as fast as possible.

The idea is a good one for shipmasters. Leaving aside the fear of piracy, the Red Sea is disliked because even though its average width is about 200 miles over its 1,400 mile length, it is dotted with large reefs which make navigation difficult, and it is noted for its uncharted and unpredictable crosscurrents. Those crosscurrents, incidentally, are one reason why oceanographers and geologists are interested in learning more about the sea. For no rivers as such flow into the sea, and some crosscurrents flow contrary to prevailing surface winds. No one knows why.

From a geological point of view, the Red Sea is considered to be a graben, or a grave-like crack in the solid rock of the earth's crust.

It is thought to be part of the Great Rift Valley that extends down through Africa and up through and

beyond the Dead Sea of Israel and Jordan.

The waters of the Red Sea are among the saltiest in the world, and in certain spots "hot brine pools" were known to have formed.

Swedish oceanographers began to study seriously the hot brine pools as early as 1948. Their published reports attracted the interest of other nations, particularly those nations whose geologists knew that hot brine pools are often associated with underwater oil domes.

Creeping shores

One basic research finding led to another. Geological experts soon concluded that the sides of the Red Sea were moving away from each other at an average rate of about one inch a year.

This indicated that the bottom of the sea might contain minerals brought up from deep inside the earth. The difficulty of making detailed geologic and mineral surveys, however, was complicated because many of the Red Sea shelves were claimed and controlled by various nations, as mentioned above.

Last fall, however, an American oceanographic expedition working under research grants given by the National Science Foundation made a detailed survey of the hot brine areas across the entire area of the Red Sea.

The group explored and took cores of three areas of the Red Sea known as the Atlantis II, or A-2 deep, the Chain deep and the Discovery deep.

At the request of the United States Geological Survey, Dr. David A. Ross, chief scientist for the Woods Hole Red Sea expedition, agreed to try to translate into understandable English some of the things he thought his expedition had found out about the hot brine pools.

The three pools, he said, which are some 4-5,000 feet below the average depth of the Red Sea, contain abnormally high concentrates of heavy metals, including iron, zinc, silver and gold.

The pools are "lined and overlaid with one of the richest deposits of heavy metals known to exist."

The heat-flow from the earth beneath the pools is the highest of any spot in the world. It is as if the pools are being heated from a "bunsen-burner effect within the earth."

He was asked: "If you know where one of the richest mineral deposits in the world is, why don't you go over with a dredge and come back rich?"

Dr. Ross answered:

"For the same reasons that earlier geologists who knew about the Mesabi Iron ore range didn't go out with bucket and shovel and try to get rich. It takes millions and millions of dollars worth of equipment to mine the Mesabi profitably, even after you know the ore is there. Then, too, there are international problems about ownership of the Red Sea floor. Even so, I expect that someone will be profitably mining the mineral deposits near the hot brine pools in the Red Sea within a decade."

Science Month

Computerizing lobsters

LARGE male lobsters cannot mate with smaller females, and yet the females drive away the smaller males that can mate with them. Unfortunately, only about four percent of the female lobsters survive to become proper mates for the larger males. Consequently the female, who can only mate for a single 48-hour period every two years, loses her mating chance and a lot of little lobsters which could be born are not. That's the latest word from the computers on what used to be the private concern of the lobster world.

Profiling the life cycle of a lobster colony is a new achievement of computerization. The birth-to-death cycle of *Hemarus Americanus*, the New England lobster, is being simulated by an IBM System/360 at the University of Rhode Island. The study is directed by Saul B. Saila, director of the university's Marine Experiment Station. The simulation tests the effects of man's and nature's laws on a typical lobster population and helps reveal clues about the crustaceans' habits, instincts and behavior patterns.

A surprising conclusion of the computer study is that laws protecting large lobsters actually reduce the total catch without effectively increasing the lobster population. Conversely, the computer also indicates that laws protecting egg-bearing females substantially increase the birth rate of a lobster colony.

Laws protecting large lobsters like this barnacle-encrusted one reduce over-all death rate, but don't increase birth rate.

The study also revealed that lobsters are not wanderers, but egg-bearing females can be moved to other areas in attempting to start lobster colonies. The egg-bearing females, once moved, will not leave the new area until they have shed their eggs. Dr. Saila called this significant because new lobster communities could be started with the shed eggs.

Handy "heart trouble"

The world's most useful neurosis is used today by individuals who Dr. Frederick A. Whitehouse calls "cardiacs without heart disease." He claims that 20 million Americans think they have heart disease but do not. One reason put forth for this illusion was that a good many consider "heart trouble" as a good way to escape problems.

Dr. Whitehouse, professor of education and director of the rehabilitation counselor training program at Hofstra University, claims his study shows five to 27 percent of psychiatric referrals are functional cardiacs and two investigators found that 48 percent of those referred to a cardiac clinic didn't have heart disease. He defines a functional cardiac condition as one in which nothing physically wrong with the heart can be found. He points out that few in a household would argue or resist someone who exhibits alarming symptoms for fear he might drop dead.

Dr. Whitehouse criticizes mental health and heart associations and psychologists for their lack of concern with the problem. He also criticizes physicians for confusion and error in determining if heart disease really exists.

Foam foils fire

A heretofore secret material that cuts down the risk of fires and explosions in our Air Force planes when hit by enemy fire, or crashing in Vietnam, is being tested as a protective agent in civilian airplanes, automobiles and other types of fuel systems.

Polyurethane foam, an orange synthetic resembling an artificial sponge, is stuffed into fuel tanks. It covers the space inside the tank but only slightly reduces fuel capacity. Fuel flows through the foam.

The polyurethane foam lining eliminates fuel from exploding or catching fire even though it may leak out of a ruptured fuel tank. Air Force spokesmen say the foam, developed by the Scott Paper Company, has been used in Vietnam for about nine months. Navy and Army officials are expected to adopt the foam-tank technique for their aircraft.

Pigs aren't so dumb

Scientists now suggest that you should consider being called a pig a compliment rather than an insult. Not only has he proved his ability to survive an atomic blast, but he's one of the most intelligent animals, ranked with the chimpanzee, orangutan, gorilla, dog and cat. At an early age the pig proves to be the only animal that can be trusted to take care of his feeding.

In tests, for instance, pigs learned to operate complex feeding installations by opening the right doors, going to the proper compartments

This V/STOL tactical fighter plane is equipped with retractable engines that swing out of the fuselage, allowing it to make vertical or short-run take-offs. When not in use, the retractable engines are hidden in the fuselage, in front of the wings. The United States and Federal Republic of Germany are joint developers of unique plane design.

and selecting the best combination of grain and concentrates. Horses and cows stuffed down the contents of whole feeding troughs before starting on a new one, resulting in severe indigestion.

Scientists claim that pigs, if allowed to care for themselves, would be the cleanest of all animals. They wallow in the mud only to bathe and cool themselves. Their skin has almost no sweat pores and their bristles are too short to protect them from heat and insects.

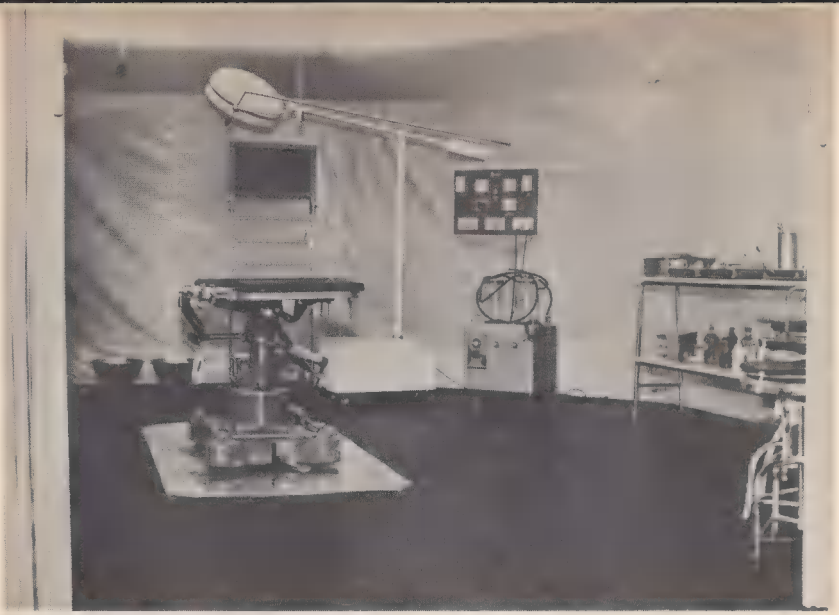
Pigs have proved that, when on their own, they fare very well. Some have climbed into trees during a flood and waited for the water to subside before returning to earth. And a pig was the only creature to survive the atomic explosion on Bikini Atoll in 1946. No one knows how it managed to stay alive but, after the blast, it was observed splashing around in the lagoon.

New fighter design

Retractable engines that swing out of the fuselage enable a new tactical fighter plane to make a vertical or short-run take-off. The system is under development jointly for the United States and the Federal Republic of Germany. The V/STOL fighter is powered also by deflected thrust lift-cruise engines.

When not in use, the swing-out engines are tucked in the fuselage, just forward of the leading edge of the wings. Mounted on arms which swing out from the fuselage, the engines can be tilted to varying degrees from the horizontal to provide vertical lift or short take-off capability. If the main cruise engines become inoperable, the swing-out engines may be used to give the craft a safe return-home capability.

The V/STOL fighter is being de-



The Octatent—a portable emergency surgery room which can be put up in less than three hours, offers the facilities of any permanent operating room. Use in disaster areas and as an auxiliary surgery space will be a major function of the portable room.

veloped by EWR/Fairchild International, a joint venture company composed of members of Republic Aviation Division of Fairchild Hiller of the United States and EWR Sud (Entwicklungsring Sud) of the Federal Republic of Germany.

Instant appendectomy?

An air-conditioned, portable emergency surgery room that can be erected in less than three hours is a new product of British manufacturer John Bass, Ltd. The auxiliary operating theater—the Octatent—is basically an 18-by-18-foot, eight-sided PVC tent, high frequency-welded into one piece and suspended from a tubular steel frame. The walls are put up and secured to the rubber sheeting floor to seal it from the outdoors.

All the frame attachments are on the outside of the tent. Access is provided through a spacious air lock extension that has folding doors at both ends and sufficient space for washing facilities. The interior is illuminated by fluorescent tubes and sterile air is maintained by filtering through a pressurizing air-conditioning system.

The emergency surgery theater can be erected by unskilled labor in any room of sufficient size to provide the facilities of a permanent operating room. To establish a complete surgery complex, a number of adjoining smaller rooms can be added, providing anesthetic and recovery rooms and a sterile dressing store.

Major application for the Octa-

tent is providing surgery theater facilities for hospitals whose main theaters are out of action while undergoing sterilization or reconstruction, giving on-the-spot theater facilities in disaster areas or in underdeveloped countries, and additional theater facilities in existing hospitals during emergencies.

Few pesticides in dinner

You can stop worrying about ingesting enough pesticides in your food to poison you, according to Food and Drug Administration (FDA) scientists. They claim, however, that continued surveillance of the poison content of foods will be needed to prevent "residue levels" in food from becoming a major health threat.

FDA spokesmen say the agency has sampled thousands of food items to determine if Interstate Commerce Commission limits on pesticide content in raw agriculture products are being observed. The conclusion, as reported in *Science Magazine,* is that some poison residue was found. Only 19-thousandths of a milligram is actually ingested daily by individuals. Six-hundredths of a milligram of pesticides is the "acceptable" limit of daily pesticide intake by a person.

"I asked it a real doozie this time!"

NEW FOR PEOPLE

Vibrating safety razor that slices rather than scrapes off whiskers utilizes conventional razor blades but uses no wires or batteries. Cutting is achieved by minute side-to-side vibration of blade, 6,000 times a minute. Spring-wound, one winding keeps razor running for three minutes or more. Two-piece head is detachable. By Stahly, Inc., Highland Park, Ill.

Elevator door control system will handle future transit riders with greater safety and smoothness. As in modern automated elevators, the doors will operate without slamming and have fail-safe interlocks for passenger protection. Otis doors can't be accidentally opened.

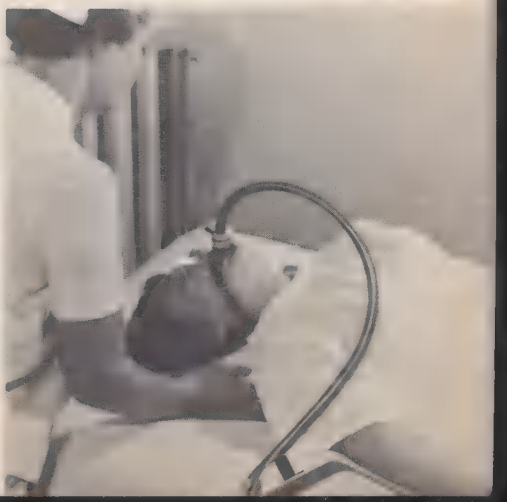
Cut off in the middle of a conversation. That's what will happen to your teen-ager with the Call Limiter. The electronic switch, developed by Pulse Communications, Alexandria, Va., warns users when they have exceeded time limits. First the warning, then cut off.

Fogging system used on tractors, automobiles, in patios, yards, barns or campsites kills flying and crawling insects. Killing power lasts for hours or even days. "Bug Doom" fog unit is a product of Invent-O Corporation, P. O. Box 44, Madison, Wis.

Sun-glare problems may be eliminated by a product called "Frosty" which is a thin window coating that breaks up the direct rays of the sun but permits transmission of adequate light for normal use. Enough sunlight comes through Frosty-treated glass to permit reading of fine print. Sun-X International, 4125 Richmond Ave., Houston, Tex. 77027.

A lightbeam that gives as much glow as a flashlight but can be used in inaccessible places is offered by Bryce-Branton, 690 Southern Avenue, Muskegon, Mich. The flashlight, like a gooseneck, can be twisted, bent or snaked into difficult openings.

No tanks or regulators are needed by automatic respirator made by RETEC, Inc., Portland, Ore. Unit powered by 110V A. C. electric outlet or battery of boat or any vehicle. Gives quick aid during crisis in most any respiratory problem.



Zoo visitors rarely get a chance to see nocturnal animals like these giant fruit bats, or flying foxes, in action. Zoos are now trying to trick animals into staying awake.

Animal world of darkness

With the recorded hoots of owls and roars of alligators filling the air, the place is going to sound just like an old Hollywood horror movie. With giant bats gliding through the eerie red tinged semi-darkness, it is going to look like an old horror film too. What is it? Nothing more sinister than the new World of Darkness pavilion to open at New York's Bronx Zoo early next year.

The World of Darkness is a cavern-like, windowless structure, designed to show off nocturnal animals, by fooling them into thinking that day is night.

About two thirds of the world's mammals are night rovers. Such creatures make poor zoo exhibits. They are up and active when the zoo is closed and empty, but to daytime visitors they look like nothing more than a ball of fur as they lie curled up asleep in a corner of their cage.

Zoos have been trying to coax nighttime animals into daytime activity by a number of different methods. Early this year the London Zoo opened a special section for nocturnal animals called the "Moonlight World" in the basement of the brand new Charles Clore pavilion for mammals. The ultra-modern pavilion contains many innovations in the display of zoo animals, but the "Moonlight World" has proved the most popular with visitors.

The Bronx Zoo has pioneered with keeping nocturnal animals since 1961, when the zoo opened its first "red light room."

The old "red light room" and the soon to be opened World of Darkness are both illuminated only by strong red light. The odd lighting is not just used for eerie effect. While human visitors can see the animals with reasonable clarity in the red light, such light is not within the animals' range of vision. Reason for this difference can be found in the night light sensitive pigment in the eye called rhodopsin. Man's retina contains two types of vision cells, cones and rods. The cones discriminate colors, but are excited only by relatively intense light. The rods are sensitive to minute accounts of light, but do not respond to colors.

(Text continued on page 36)

London's new Charles Clore pavilion for mammals (right) features many innovations in keeping zoo animals. The most popular has turned out to be the "Moonlight World" section for the display of night animals. The World of Darkness pavilion (below) which will open next year at the Bronx Zoo, is a weird windowless structure shaped like a doughnut with a bite taken out of it. Red-light interior will feature recorded sounds of the nighttime world.

Animals of the night

THE big-eyed animals of the night are often the cutest and oddest creatures around. The enormous, saucer-like eyes and the huge ears characteristic of dwellers in darkness are necessary for picking up faint sight and sound clues. The animals on these pages are among those that will be on display in the night exhibits in New York and London.

The Galago or Bush Baby is gregarious, arboreal and nocturnal. If disturbed during the day they move slowly, but at night the little animals are extremely active and agile.

Elephant shrew (left) is native of Africa. This insect eater is active in the day but prefers a night world. The mouse lemur (below) is a native of Madagascar. In the wild, mouse lemurs are shy, nervous and hard to tame. Sometimes they fight among themselves. But they have lived 7 years in captivity.

Baby hog badger (above) from southeast Asia was one of the animals on display in London "Moonlight World". Creatures are quite common over most of their range. Tiny pigmy mouse (below) is one nighttime rodent.

Interior of the pioneering "red light room" in the Bronx Zoo. Technique will be used in new "World of Darkness."

The rods come into play when the light is too low to get our cones working. Rhodopsin builds up in the rods in darkness, but is destroyed by large amounts of light.

Human eyes are adapted for daytime vision, although we do have enough rods to allow some nocturnal sight. Creatures of the night, however, have sacrificed color vision to pack as many rods as possible into the retina, and the sensitivity of their eyes at night far exceeds ours.

Consequently, under ordinary circumstances, it is impossible to see one of these animals without letting him see you more easily. Impossible, that is, unless you know the secret which lies in the spectral sensitivity of rhodopsin. The substance is deep red in color. It absorbs all other forms of visible light, but reflects red. Red is, then, an "invisible" form of light to an animal whose retina contains mainly rods.

But aside from their "red blindness," nighttime animals have an almost uncanny ability to see in the dark. It is said that the human eye, adapting to darkness from daylight, increases its sensitivity about ten thousandfold. How much more sensitive the almost pure-rod eye of a nocturnal creature is we can only guess.

Prof. Lee R. Dice once concluded that an owl could see a dead white mouse on dark soil in the laboratory "very well" at less than one-millionth of a foot candle of light, and that the owl could see in light between one-tenth and one-hundredth the minimum intensity necessary for man.

If the nocturnal animals are to be fooled into believing that a red-lit day is really a dark night, the illusion must be continued, and the animals must be given a false day in which to sleep. Around 10 p.m., long after the visitors have gone home, the lights will be turned on in The World of Darkness. Bright white flourescent light will flood the caves and caverns, driving the animals into their daily sleep.

In order to do this, the animals' habits and body processes must be re-cycled. The problem is similar to that faced by long distance jet passengers. The zoo has set up "conditioning rooms" in which the animals will be gradually coaxed into switching their day-night routine.

Adjustment period

"In general, we're starting the job of reversing them (the animals) the minute we get them," says William G. Conway, general director of the Bronx Zoo. "It varies with the species, but they usually adjust within three weeks or less."

One of the zoo's curators told a *New York Times* reporter, "If an animal comes from Australia, on the other side of the world, he doesn't have to switch. He's already on the right cycle if he comes in by air."

"An animal like that can come in here and never get off his old schedule."

Better life spies for space

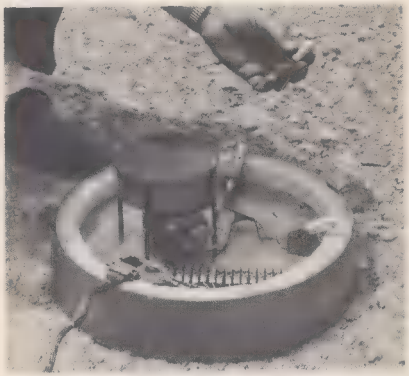
DOES life exist anywhere besides earth? This question has plagued scientists and the average citizen for years. Although few scientists think human-like creatures exist on other planets, most feel combinations of elements on Mars or Venus may form simple living organisms.

A new science, exobiology, is concerned with this "unearthly" life, none of which is available for study now. This isn't stopping scientists, however, who are preparing for their chance when a sensing device will be landed on Mars and possibly Venus. (These are the only two planets which can be reached with present equipment and return reports to earth.)

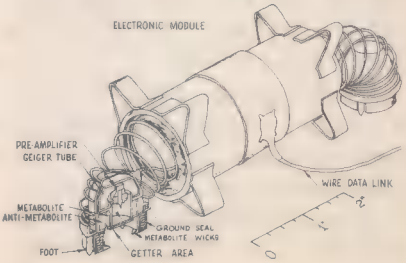
Life detecting instruments are currently being readied by NASA experts and other laboratories. Three major types exist so far—*physiological*, for collecting and analyzing samples for living organisms; *chemical*, for identifying certain amino acids or peptides—necessary ingredients for proteins in our life system; and *morphological*, for analyzing form and structure.

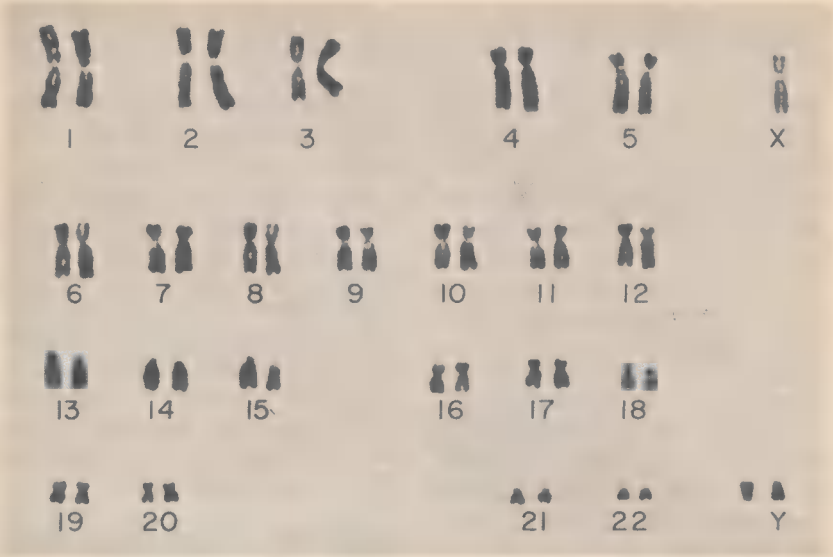
Exobiologists are finding their biggest problem lies in deciding when to start the search for extraterrestrial life. Some want NASA to begin as soon as possible (about 1968), with a series of small landings on Mars. Others want to wait until bigger packages can be landed, maybe as late as 1973. This is the deadline because, after that, positions of Mars and earth will be undesirable for another decade.

Advocates of the latter say a successful first mission is imperative to avoid possible contamination of the planet, and bigger instruments would have a better chance of success. Those favoring the 1968 date argue that smaller capsules can be completely sterilized. But both groups agree in the desire to get their instruments to Mars and Venus ahead of Russia.



Gulliver Life Detection Instrument (above), and later design, Mark IV (below), will collect samples from Mars for study.





Chromosomes and crime

Crime and delinquency, often linked closely with environment, are now being connected with genetic make-up. Some hardened criminals may be unsuspecting victims of inherited chromosome mix-ups.

by J. A. Maxtone Graham

For many years, sociologists have believed that crime and delinquency are the result of environment. Now, according to a pair of Scottish doctors, it seems likely that a sizable proportion of hardened criminals have actually inherited their unfortunate characteristics.

According to Dr. William Price and Dr. Peter Whatmore, it is a matter of chromosomes. Chromosomes are vital to the transmission of hereditary characteristics; most of us have got 48 of them; according to their make-up, we are blue-eyed or red-haired, tall or southpaw, male or female.

It is the sex-determining chromosomes that Price and Whatmore have been examining. A child's mother always passes on a female (X) chromosome; the father can add either another X, making the

child a girl, or a Y, which produces a boy. In biological shorthand, therefore, females are XX and males XY. The trouble comes when, by some inexplicable freak, a person inherits an *extra* sex chromosome. For instance, boys—perhaps one in every 1500—can inherit an extra X (female) chromosome, making them XXY's. These—"eunuchoid" males—have a tendency to breast development and infertility.

Recently, Price and Whatmore have been studying XYY's. These are those males—fewer than 1 in 2000—who have inherited an extra male (Y) chromosome. Dr. Whatmore works at Carstairs Hospital, Lanarkshire, Scotland, whose patients need special security on account of their dangerous or criminal propensities. The 342 inmates are mainly sexual deviants, alcoholics, firebugs, aggressive or inadequate psychopaths.

Blood tests showed that nine of them are XYY's—"double-males". A random control group of 18 normal XY's was taken from the rest of the hospital; for nearly three years the doctors then collected every possible detail about the past history of all 27 people—schooling, parentage, upbringing, social status and incidence of crime among relatives.

The results were startling. Among the 18 normal XY's, it was perfectly easy to account for their criminal past. There was a convincing history of crime among their 99 immediate relatives: in fact, families of seven of the XY patients shared as many as 139 convictions.

By contrast, among the XYY's, there was hardly a family crime pattern at all. There was no insanity or lawbreaking among the parents of these double-males, and only one of the three siblings had had a clash with the law—over the theft of $14 from an employer. They came from model families, modern homes and good schools. How, then, could these nine men have become committed so early to a life of crime, including assault, sexual offences against children and murder? (Their first conviction was at the average age of 13.1 years: among the XY's it was about 18.)

Genetic irregularity

The Scots doctors are fairly sure that chromosome irregularity is the cause. They compare it with the Mongoloid condition in children which is also caused by unusual chromosome make-up. "The parents of Mongoloid children are perfectly normal," says Whatmore, "but when a Mongoloid baby is born it is possible to predict quite precisely the course of its development." So with the XYY's: unstable, irresponsible, unaffectionate, intolerant of frustration, with only a few. utterly unrealistic plans for the future. They were persistent, recidivist criminals, working with little skill, and showing little financial gain. "The link with criminal violence is not firmly established yet," Dr. Whatmore continues, "but our ex-

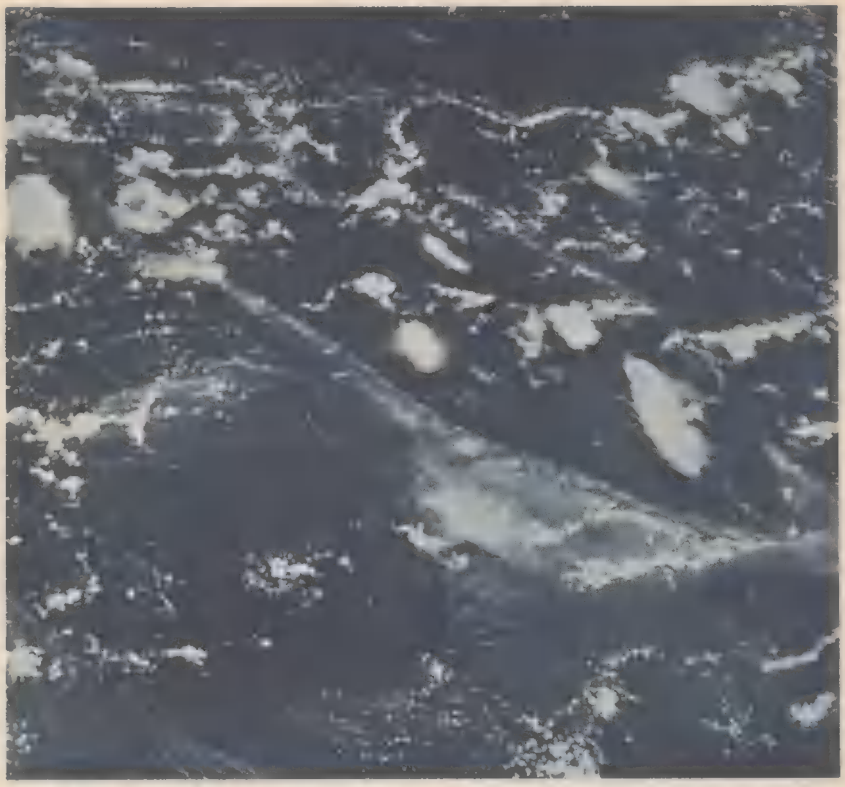
periments indicate a strong probability that can only be confirmed or denied by further studies." He would be glad to hear of parallel investigations being started in other countries.

If the studies do confirm such a link between unusual chromosomes and inexplicable crime, penologists will be able to screen recurrent lawbreakers from those whose environment sent them wrong and those who were born like that and couldn't help it. The former, presumably, could be cured; the latter, not. A cheap and simple blood test can quickly determine the pattern of a person's chromosomes. By passing a hollow needle through the wall of a pregnant woman's uterus, and withdrawing some amniotic fluid, it is even possible—although with some risk—to test the chromosome make-up of an unborn baby.

It might make strong ammunition for the eugenists, who could claim that violent criminals are thus detectable before birth. Other social and legal problems may arise: for example, will chromosome patterns be quoted by criminal "double-males" in court, to prove partial or complete lack of responsibilty?

In the meantime, parents of XYY's can take comfort in only two things: the child can't help it, and it was no fault of either parent. The situation is the result of a tragically unfortunate draw in the biological lottery.

"Rumors going around that this company is considering complete automation, and that you will all soon lose your jobs, are completely unfounded . . . this is a recording."



Satellite eye on the sea

THE mysterious migration path of the sea turtle from its feeding grounds to place of birth in order to reproduce (often across a thousand or more miles of ocean with no apparent "landmarks"), may soon be mapped as carefully as major city thoroughfares. Scientists hope to "wire" the turtles for the latest in ocean-to-satellite communications.

While this sea animal's migration may not be of world-shaking significance, the plotting of the turtle's remarkable oceanic voyage is only one of the mysteries which may be explored through the combined forces of a radio-like transmitter, a small electronic "black box" and an orbiting satellite.

This new system will get its real chance early next year when the Nimbus B satellite carries the little "black box" known as the Interrogation, Recording and Location System (IRLS) into orbit. Developed

by the National Aeronautics and Space Administration's Goddard Space Flight Center, the IRLS will record and relay data from stations all over the world. It can locate a sending apparatus to within 1.5 miles, making feasible the tracking of objects at sea by the satellite overhead. Information from up to 20 surface stations during each orbit of the Nimbus satellite can be collected and subsequently dumped into high-speed readout at stations in Fairbanks, Alaska, and Rosman, N.C.

New and better snoopster

A system such as this could offer a better understanding of oceanic conditions and thus unfold vast opportunities for more accurate maps, new food resources, more tidal wave warning, new mineral resources, more accurate and less expensive notice of floating ice and better weather prediction.

And while signals between land bases and satellites are nothing new, a system to include the 71 percent of the earth's surface covered by oceans is a dream long sought by oceanographers. Oceanographic data, in the past, have been collected mainly by instruments mounted on ships or towed by them. This is both a painfully slow method of gathering information, even when modern radar, sonar and electronic equipment are used, and a difficult to interpret method because data from different locations are taken at different times. Water temperature, for example, may vary from time to time in the same place or from place to place at the same time.

One possibility for overcoming the time problem would be to establish fixed stations at various locations over the surface of the ocean and record continuously. This is only practical, though, if the stations can be automated and can send reports to a central station on shore.

Small nuclear power generators have made automated, instrumented buoys a reality, although only a few are now in operation. Physical aspects, such as the size of the ocean and the curvature of the earth, severely limit the system. Since radio signals travel in straight lines, no single land station can receive signals from all parts of the ocean.

Satellites, however, if high enough, can observe the whole ocean at once and receive signals from transmitters scattered over an area of up to half the earth's surface. With IRLS's ability to locate sources, sending stations can be stationary or drifting.

Nimbus B to orbit

The Nimbus B satellite, carrying IRLS, will be launched into a polar orbit 600 miles above the earth's surface. Although this is not high enough to see the whole ocean at once, the Nimbus III (which it will be called once in orbit) will view a wide strip each time around. As the earth rotates beneath the satellite's orbit, the range of view will gradually cover the whole ocean.

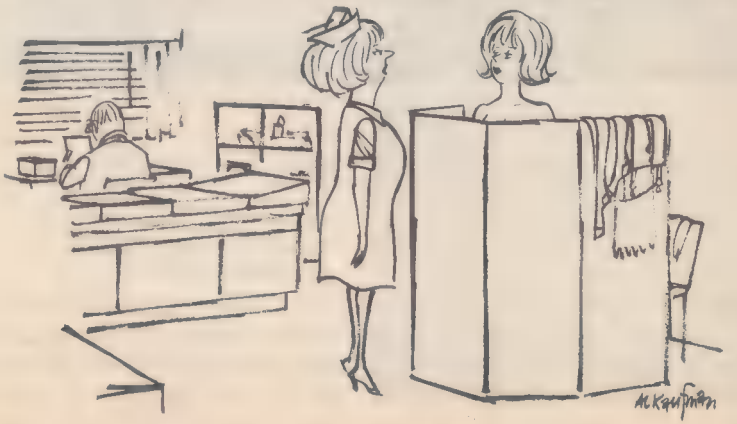
Many experiments are already planned for the system. The Naval Oceanographic Office will plot the drift of an Arctic iceberg. An IRLS transmitter will be attached to the ice. The Navy will also set out an instrumented buoy south of the Virgin Islands to record and report water temperature, salinity and wave height.

Bird migrations, like those of the sea turtle, will also be investigated. Wind and atmospheric data will be collected under auspices of the National Center for Atmospheric Research by placing transmitters on freely drifting balloons.

George Tajima, vice-president of Bissett Berman, a West Coast firm specializing in oceanographic instrumentation, says direct observations or photographs by Mercury and Gemini astronauts have already shown the practicability of collecting, by satellite, data on sea surface temperature and weather that affects it, iceberg flow and ice area, the flow of nutrients in the ocean and the mixing of Arctic water with the rest of the ocean.

"A platform in or on the ocean is fairly essential, however, when a scientist requires refined measurements and information on sea life," Tajima says. Although rather far out in the realm of future feasibilities, Tajima says, "It may be possible to measure sea slope (dynamic ocean changes) or the progress of a destructive tidal wave by remote instruments which relay their data quickly by satellite."

Other anticipated uses for oceanographic sensors reporting by satellite include detecting volcanic activity, measuring and plotting currents, observing the habits of plants and animals in the sea, assessing physical and chemical relations between the atmosphere and the ocean, plotting shoals and coastlines, measuring temperature changes over the surface of the sea, determining sea level and detecting and tracking surface ships and submarines.



"Okay—the doctor is ready for a peek."

NUCLEAR PHYSICS

SCIENCE DIGEST SPECIAL

That infamous mushroom cloud that rose over Nagasaki, at right, and Hiroshima as a result of atomic bomb explosions ending WW II, announced the nuclear age.

K.F.S.

Nuclear age celebrates silver anniversary

by Isaac Asimov

THERE is no danger that men will ever forget what happened beneath the stands of the football stadium of the University of Chicago on Dec. 2, 1942—just 25 years ago this month.

A 1,400-ton pile of layers of uranium, uranium oxide and graphite had been built. It was 30 feet wide by 32 feet long by 12 feet high.

Nuclear fission was taking place in the uranium content of the pile, and each fissioning atom was producing neutrons to fission others. Cadmium rods within the pile soaked up neutrons to keep the situation from getting out of hand.

Slowly the cadmium rods were pulled out, and at 3:45 p.m. the neutrons were allowed to accumulate to the point where energy started pouring out of the pile in a steady stream. Mankind was witnessing the first self-supporting nuclear reaction and the nuclear age had been born—though only a few men actually knew it at the time.

A bottle of Chianti was broached as jubilant men gathered about Enrico Fermi, the Italian physicist in charge.

Out went the cryptic telegram announcing success: "The Italian navigator has entered the new world." Back came the question, "How were the natives?" and the final answer, "Very friendly."

For nearly half a century scientists had known there were incredible stores of energy locked within the nucleus of the atom, but there had seemed no way of getting it out. Many physicists, including the great Ernest Rutherford, felt that mankind would never succeed in tapping nuclear energy.

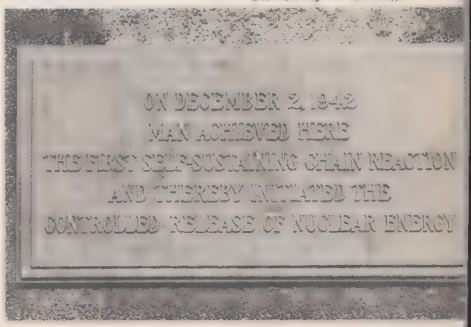
Then, in 1939, had come the discovery of uranium fission. At last there was the possibility of a chain reaction; one atomic breakdown setting off another. In little more than three years the energy source was tapped.

Events followed with dizzying speed. It was wartime and the coming of the nuclear age had to be kept secret. A vast nuclear explosion was set off at Alamogordo, N. M., on July 16, 1945, sobering the awed onlookers, and within a month, two other bombs were set off over the Japanese cities of Hiroshima and Nagasaki, ending World War II. The nuclear age was less than three years old when those bombs announced its existence.

The fission bomb could set off the much greater hydrogen fusion bomb, and this was first accomplished on Nov. 1, 1952, when the nuclear age was not quite 10 years old. Four nations now possess hydrogen bombs: the United States, the Soviet Union, Great Britain and Mainland China. France has the fission bomb.

Nuclear power has its peacetime applications, too. The reactors produced radioactive isotopes in large quantities, and many fields of research were revolutionized by their presence. The study of biochemis-

A plaque commemorates the birth of nuclear power in 1942 at University of Chicago.
University of Chicago


ON DECEMBER 2, 1942
MAN ACHIEVED HERE
THIS FIRST SELF-SUSTAINING CHAIN REACTION
AND THEREBY INITIATED THE
CONTROLLED RELEASE OF NUCLEAR ENERGY

A nuclear reactor was placed aboard the **USS Nautilus** in 1955 to make it the first nuclear powered submarine. In 1960, another nuclear submarine, the **USS Triton**, circumnavigated the world completely submerged during the three-month journey.

try in particular has bounded forward.

Nuclear reactors could be, and were, designed to deliver power at a steady, controlled rate without exploding. The first reactor designed to produce electricity for civilian use was set up by the Soviet Union in June 1954, when the nuclear age was 11½ years old. By October 1956, Great Britain had Calder Hall in operation and in May 1958, the United States had opened a nuclear power station at Shippingport, Pa.

A nuclear reactor was placed on the *Nautilus*, the first nuclear submarine, in 1955. By 1960, the *Triton*, a later nuclear submarine, had circumnavigated the world underwater in a journey that took three months, and the nuclear age was then 17 years old.

The danger of a nuclear war has become greater as the nuclear age advances, but the nations have always drawn back from the brink. In 1963, when the nuclear age was in its 21st year, the chief nuclear powers, the United States, the Soviet Union and Great Britain, showed their awareness of its dangers, by signing a ban on open-air testing because of the risks of increasing background radiation.

On the positive side is the fact that man's energy problems may be solved for good. Earth's supply of uranium and thorium is a potential source of fission power and neither is exactly a rare metal. Uranium and thorium are thinly spread through the crust, but under the lash of necessity, mankind can extract even thin quantities.

The small amount of uranium and thorium in an average ton of granite would supply the energy of nine tons of coal, and common though coal might be, granite is even more common.

Yet as we stand here on the silver anniversary of the nuclear age, it cannot be denied that we seem to be resting on a plateau. Everything that has happened so far stems directly from the moment when that first nuclear reactor went into action under the football stands. We have been exploiting that great breakthrough magnificently, but we are still waiting for a second breakthrough, and we need one.

It is still the power of fissioning nuclei that does it all—in 1967 as in 1942—and nuclear fission has its drawbacks. One of the chief of these is that the products produced by fission are strongly radioactive. The radioactive "ash" produced by reac-

United Press International

tors increases in quantity each year. The problem of disposal is acute now and will grow enormous.

Eyes cannot help but turn longingly toward a competing type of nuclear reaction; the fusion of hydrogen atoms to helium, as in the hydrogen bomb. What is needed of course, is not a fusion explosion, but *controlled* fusion.

If the fusion reaction could be controlled, it would be a source of power that would dwarf even that produced by uranium fission. The hydrogen isotope, deuterium, is, for several reasons, the most likely source of that power. While it is a comparatively rare isotope, there is a whole ocean to use as a source for it. A single cubic mile of ocean water contains enough deuterium to satisfy our energy needs (at our present rate of use) for over four centuries—and there are three hundred million cubic miles of ocean water altogether.

Furthermore, the fusion reaction products are not radioactive. The chief product is helium-4, which is perhaps the least dangerous substance in existence.

But to ignite the deuterium requires a temperature of a couple of hundred million degrees. To reach that temperature, maintain it, and hold the super-hot deuterium in place by magnetic forces is not easy and has not yet been accomplished.

Our position with respect to controlled fusion power—the second great breakthrough of the nuclear age—is now just what our position toward nuclear power generally was in the 1930s. We know it's there and we want it terribly, but we don't quite know how to get it.

The solution with respect to nuclear power generally came with the discovery of uranium fission—a totally unexpected type of nuclear reaction. Presumably, the answer to practical controlled hydrogen fusion may come with some equally sudden, equally unexpected and equally unpredictable discovery.

The most useful possible discovery in this connection would be one that suggests a method for producing fusion at a much lower temperature than is now possible.

Perhaps some nuclear catalyst will be discovered. Someone may accidentally discover, for instance, that in the presence of a stream of a certain variety of meson under certain conditions, hydrogen nuclei will

fuse at temperatures of merely billions of degrees rather than hundreds of millions. Controlled fusion would then become at once possible.

Or what about the quarks, those suggested building blocks of protons and other subatomic particles? The existence of quarks is as yet problematical, but the new particle acclerator about to be built at Weston, Ill., may produce them.

Quarks, joining to form protons or neutrons, would release energy at rates several times greater than ordinary fusion reactions. It is unlikely that even the giant Weston accelerator would produce quarks in quantity. But what if it turns out that even a few quarks can ignite hydrogen fusion as a small detonator can set off a ton of dynamite? Quarks, manipulated under the proper circumstances, would then be the key we need.

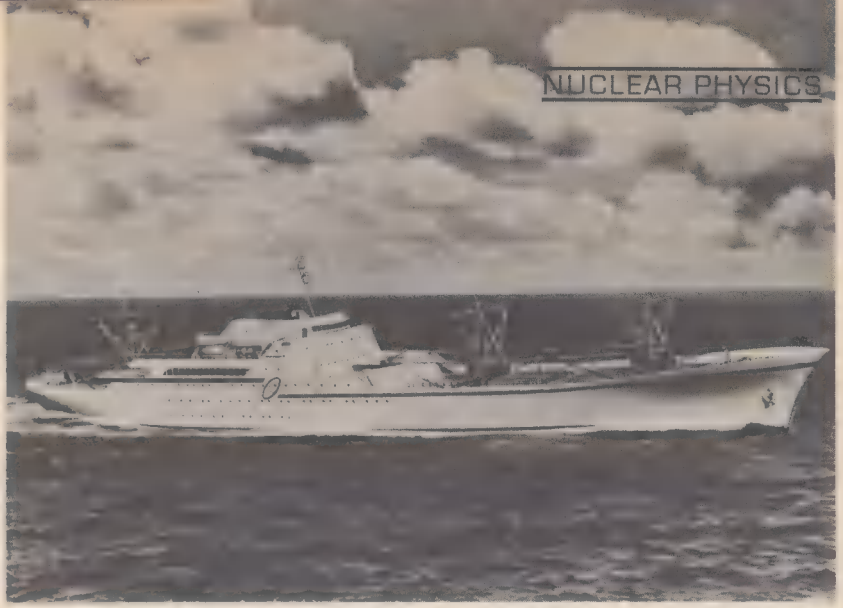
When the breakthrough will come, it is impossible to say. I would like to suggest, however, that it will come within the next quarter-century.

I will take the chance of predicting that when the time comes, 25 years hence, to prepare an essay on the Golden Anniversary of the Nuclear Age, one will be able to go on to describe the actual existence of a world on the threshold of cheap and infinite supplies of energy.

With controlled fusion power a reality, as I think it will be by then, new speculations concerning still further progress will suggest the establishment of a full-scale, permanent colony on the moon, powered by fusion, and the building of a new generation of fusion-powered space vessels that will carry man to the boundaries of the solar system by the first centenary of the nuclear age.

Foreign ministers for the U.S., the Soviet Union and Great Britain signed the 1963 test ban treaty in Moscow. Prominent political figures in the background include Nikita Khrushchev, U Thant, Adlai Stevenson, Hubert Humphrey and Sen. William Fulbright.

United Press International



So long to the Savannah?

Once hailed as one of the bright hopes of the atomic age, the nuclear ship Savannah has sailed into rough seas, and may be heading for oblivion. But the battle isn't over quite yet.

by Wayne Kelley

SINCE she first touched base at her home port on Aug. 22, 1962, the nuclear-powered *NS Savannah* has traveled more than 200,000 miles and been boarded by 1,500,000 visitors. The curious have included presidents, kings, pretenders of thrones and people who never set foot on a ship before. In fact, the *Savannah* was almost the scene of disaster when mobs of eager Irishmen, pushing for a look near closing time at a Dublin stopover, caused a near panic.

Proposed by President Dwight D. Eisenhower in April, 1955, the *Savannah,* built as a seagoing nuclear showcase, has visited some 50 ports and been responsible for 12 European nations opening major seaports to nuclear vessels. But there have been problems. The *Savannah* was laid up at its servicing base in Galveston, Texas, for 10 months in 1963-64 because of a labor dispute. A new contract and a new crew put her back to sea by mid-1964.

Next governmental budgetary cuts threatened to put the *NS Sa-*

vannah in moth balls. While arguments flew to and fro, the nuclear-powered ship was on her way to the Mediterranean on a cargo mission. At 3:45 a.m., Feb. 16, the ship passed off Fire Island, N.Y., directly over the steamship *Savannah,* the vessel for which the nuclear ship was named. The old paddle ship went to the bottom of the Atlantic in 1821.

The *SS Savannah* was the first steamship to cross the Atlantic. She sailed from the port of Savannah, Ga., on May 22, 1819, and arrived in Liverpool, England, on June 20, 29 days and 11 hours later. The paddle steamer traveled most of the time with sails set on her three masts. The little steamer was only 100 feet long, smaller than the harbor tugs which move the 596-foot *NS Savannah.*

The *SS Savannah* cost about $50,000 and her 90-horsepower engine drove collapsible paddle wheels which could be taken down at sea and stored on board. The *NS Savannah* develops 22,000 horsepower through her reactor and can travel at up to 23 knots while other merchant ships average 15-16 knots.

Models of the pioneer *Savannah* occupy honored places in the dining room of the *NS Savannah* and at the offices of the Maritime Administration in Washington.

The little *SS Savannah* sailed with its 32 staterooms empty on her transatlantic journey 148 years ago. Travelers were afraid, with some justification, of the new steam boilers.

The *NS Savannah,* with spacious accommodations for 60, was to handle paying passengers. But high operating costs have limited the number of crew members and revenue passengers. The passenger list has never exceeded 35.

Many refer to the *NS Savannah,* with her streamlined superstructure, as a "show ship." The big white nuclear cargo carrier boasts color television and is air-conditioned. The contrasts in size and costs for the *Savannah* and her nuclear successor have fascinated sailing buffs and experts. What worries many of them, however, is a possible parallel in fate.

The *SS Savannah* had her engine removed and later carried cargo up and down the Atlantic coast. She went down off the south shore of Long Island on Nov. 5, 1821, during a driving gale.

Revolutionary breakthrough

The steamship opened the way for a revolutionary breakthrough in shipping, but some critics of the nuclear ship believe the fate of the old *SS Savannah* should provide a lesson. Edward Farr, executive vice-president of the Brotherhood of Marine Officers, claims to see a "startling similiarity" in the history of the two ships.

"The *SS Savannah* made the first successful voyage under steam, then because steam was 'too expensive', her boilers were removed and she returned to sail," Mr. Farr stated. "But Britain capitalized on our

daring and thereby became the foremost maritime power just over a century ago. Are we to repeat this terrible error?"

A crewman from a New York tug boat put it this way:

"They haven't given the (nuclear) *Savannah* a fair chance. It's just like diesel before the breakthrough from steam—everybody was knocking it. But diesel is here now and steam is gone."

Other defenders of the *NS Savannah* point to the growing development of nuclear merchant ships by foreign countries. The United States and Russia both have numerous nuclear-powered naval vessels for use in war.

Other nations

Germany will launch its first atomic-powered ship, the ore carrier *Otto Hahn*, early in 1968. Russia has a nuclear icebreaker in use. Japan, Italy and, according to speculation, Red China, are giving thought to nuclear-powered shipping.

Although the "delivery cost" of the *NS Savannah* was $55 million, the research and development program surrounding her has added another $51 million—for a total program price tag of $106 million.

Documentary films for public consumption have cost the Maritime Administration and the Atomic Energy Commission just slightly less than $300,000. Some of the films have not been widely circulated.

The scrap value of the *NS Savannah*, with reactor removed, has been estimated at about $100,000.

Despite her air-conditioning and all the modern comforts of American suburban living, the *NS Savannah* was outfitted with outmoded cargo-handling equipment.

Even her most avid supporters admit that the *NS Savannah* has completed her research mission and could never pay her own way as a cargo ship. But they claim the nation's nuclear show boat has at least a few more duties to perform. The *Savannah* has not yet gone to Africa, South and Central America and the Middle East.

The nuclear merchant ship made her second visit to Savannah May 25 to pick up cargo bound for the Far East. Sixteen days after the reunion at the port, the administration put off a final verdict on the *NS Savannah* for another year.

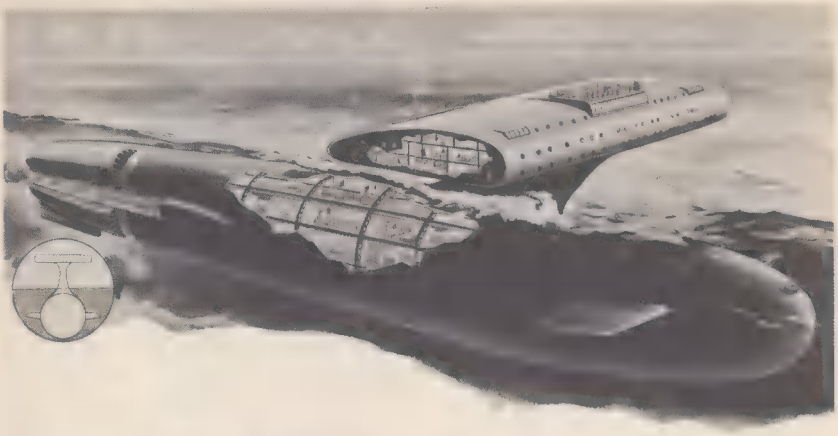
When they finally "defang" the *NS Savannah*, removing her atomic reactor, there still will be one city pulling for her last visit. Savannah has offered the ship a free berth.

An appreciative audience of 100,000 turned out in 1962, when the *NS Savannah* made her home port the first official stop of her career.

A total of 38,268 visitors climbed aboard during the one-week stay at Savannah.

The Savannah Electric and Power Co. on Feb. 6, 1967, offered free berth space for the *Savannah*, "should she be inactive for a long time."

The Maritime Administration



Popular Mechanics Drawings

In 1958 the above whale-shaped craft with superstructure for crew above water, cargo and nuclear reactor below, was considered in the realm of "dreams and schemes" by maritime engineers. Almost a decade later it is still in the realm of "dreams and schemes". The atomic revolution in the shipyard has not moved as fast as anticipated. Skipjack configuration (right), became basis for future nuclear-powered submarines.

has been informed of the offer. It was pointed out that in addition to the historic voyage of the old *SS Savannah*, the *John Randolph*, the first commercially successful iron steamship, was launched in Savannah in 1834.

Maritime Administrator J. W. Gulick said that "nuclear considerations which cannot be minimized" dictate that the ship be situated near her nuclear servicing facilities at Galveston. "Otherwise," he added, "consideration will be given to an established reserve (mothball) fleet site."

Letters are coming in from *NS Savannah* supporters. "I guess the sixth grade can't do much about it," wrote one eager Savannah correspondent in a letter to his congressman.

Don't be too sure. The sixth graders seem to be learning their civics pretty well. Just listen to what Mr. Gulick had to say in reversing the original mothball decision:

"In view of the great interest shown in the continued operation of the *Savannah*, we have reconsidered our position and concluded that, on balance, the vessel should be kept in operation through fiscal 1968."

The battle of the *NS Savannah* isn't over yet.

"Alligator on the pad!"

Behind the scenes activities before a launch at Cape Kennedy aren't always routine. Once in a while an alligator—or a few dozen rattlers—might drop in.

by L. B. Taylor, Jr.

PRE-FLIGHT test operations leading to the launch of an Atlas-Centaur rocket from Complex 36 at Cape Kennedy were abruptly halted one morning last May. An excited voice announced over the area innercom, "There's an alligator on the pad!"

Incredulous engineers and technicians rushed out of the blockhouse and, sure enough, were greeted by an angry, snorting, nine-foot-long gator which had crawled through a drain pipe onto the launching area. Security policemen lassoed the intruder and escorted it to a less populated region.

Only a few months earlier, sailors at Port Canaveral, adjacent to the Cape, were loading Polaris missiles into the hulls of two U.S. nuclear submarines for test firings at sea. Suddenly, a sentry spotted a mysterious "head" nearby in the channel.

Fearing a saboteur or spy, an alert was hurriedly sounded by the

guard, and Navy skin divers jumped into the warm water. After an exhaustive search that delayed work for more than five hours, the divers sheepishly reported to their commanding officer that the "head" sighted belonged to a giant ocean turtle—in the port for a swim.

The alligator and turtle incidents were just two in a long series of wacky, weird happenings involving birds, animals, insects and reptiles at the Cape, that, down through the years, have harassed our top space scientists.

Despite the fact that hundreds of millions of dollars have transformed the spaceport into the world's most ultramodern outdoor laboratory—complete with tons of electronic equipment, towering gantries and vast scientific complexes—wildlife still abounds in the thick palmetto scrublands separating launch pads and blockhouses from the populated industrial areas.

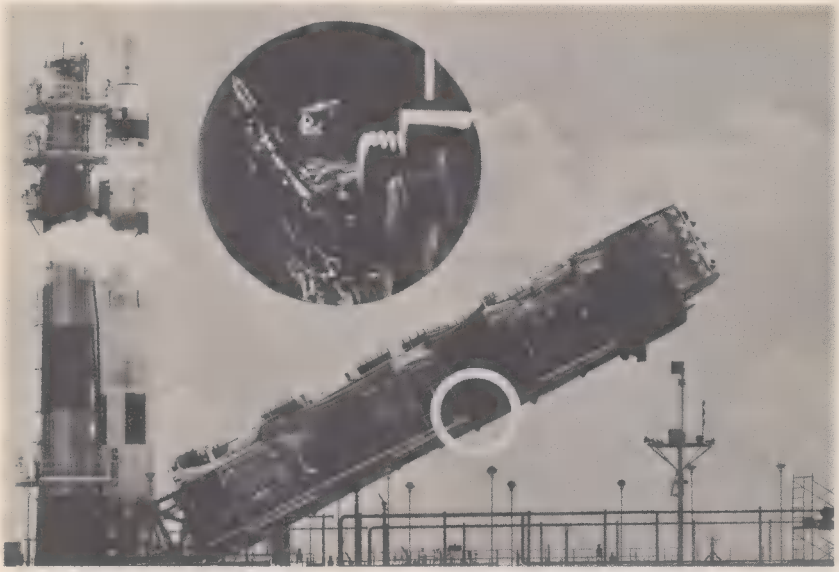
This region of Florida (halfway between Miami and Jacksonville) is, in fact, a sub-tropical paradise for animals and birds, because one perimeter borders on the Atlantic Ocean and stretches westward across Port Canaveral's rich mud flats, through pine woods, mangrove swamps, palm hammocks, citrus groves and open ranch lands—to reach the fresh water marshes of the St. Johns River.

Although most of the creatures have accustomed themselves to putting up with man's invasion and the periodic, ground-shaking rumbles from giant rockets, snakes, in particular, are a recurring problem. One surveyor, working with a road building crew, counted 24 rattlers in a single eight-hour period. But the serpent story that tops all others occurred one day in September 1958. A Polaris missile blew up several thousand feet over the Cape.

The explosion sent large, flaming chunks of twisted metal sizzling down into the brush, setting off a series of flash fires. Dozens of rattlesnakes, chased by the flames, slithered onto highways and into hangar areas. Security policemen spent a good part of the afternoon shooting some of the deadly snakes with .45-caliber revolvers and running over others with trucks.

Nothing can draw as fast a response from Cape personnel, however, as a civet cat, or close cousin to the skunk. One crawled into a rocket hangar's air conditioning duct one day, and when it became frightened and loosed its scent, people poured out of the building in

A large variety of wildlife makes its home at Cape Kennedy. Ducks swim quite contentedly in the shadow of NASA's Saturn Vehicle Assembly Building (left), and a mother blackbird builds a nest for her young halfway up a Titan missile erector (insert, below), to dismay of workers.



what looked like triple time.

The record for fast exits at the Cape is not held by humans, though. It belongs to a seven-and-a-half-foot alligator. He liked to swim in a Centaur rocket's liquid oxygen dump pond—a man-made pool into which excess rocket oxidizers are periodically poured, at a temperature of —297 F.

The gator's luck ran out one day when he was caught snoozing in the pond as fuel mechanics were dumping a load of the liquid oxygen. Eyewitnesses reported that when the super-cool substance hit the water, the alligator took off like a runaway rocket, nursing what surely must have been the only frost bitten gator tail in Florida history.

Recognizing that missiles and animals must live together, the U.S. Bureau of Fisheries and Wildlife and the National Aeronautics and Space Administration declared a 57,000 acre portion of property a National Wildlife Refuge.

Before this, Cape officials had taken such protective steps as erecting "Deer Crossing" signs on roads

leading to launch pad areas, and once a team of Interior Department agents conducted a special survey to determine if rocket noise frightened the region's vast bird populace. Two hours before a scheduled launch, they counted more than 2,700 birds, of 40 different species, within a mile and a half of the missile to be fired. When the metallic "bird" lifted off with a mighty roar, it drowned out the sound of flapping wings, but once it had disappeared in the sky, the birds settled back down to earth. The federal agents then went back to Washington satisfied that Mother Nature's creatures and the space age monsters could peacefully coexist.

Wildlife outdoes workers

Veteran Cape workers, however, feel they've often come out second in dealing with wildlife. They recall the time, for instance, an important countdown was nearly halted when a super-sensitive radar screen picked up an "unidentifiable aircraft" flying over the Cape as the launch neared. Security officers were near the panic point when a forward observer solved the mystery. It was a large pelican, nonchalantly flapping along in search of a fish dinner.

On another occasion, the countdown for the launch of a Ranger spacecraft to the moon was actually stopped cold when a crane collided head-on with a line, cutting off power to the blockhouse.

On Oct. 27, 1961, at T-minus 90 minutes in the count for a flight of the Saturn I rocket, two Cape security policemen drove northeast of the pad and turned the siren on their patrol car to full blast. They were on a strange mission: to flush from the launch danger zone a covey of 21 Roseate Spoonbills.

It seems these beautiful pink birds, often mistaken for the more familiar Flamingo, had selected a site within spitting range of the Saturn as one of their migratory rest stops along Florida's east coast. Worried Audubon Society members had spotted the Spoonbills, realized their precarious position and called Cape officials for help.

The resulting excursion by the police not only chased the Spoonbills from the area, averting their certain cremation, but the racket caused a blackening of the skies as hundreds of ducks, heron and various other creatures took to flight.

The Saturn rocket figured in one other episode. Important launch information is relayed via ground cables from the pad to data centers at points a safe distance away. During pre-flight checkouts, the data flow was spotty. Investigators found their cables nearly severed in several places. Saboteurs? No. Rabbits? Yes. A special, foul-tasting coating had to be applied to the cables to discourage further bunny gnawing.

Of all the incidents involving wildlife at the Spaceport, however, none can match the story of the persistent Red-bellied Woodpecker, which caused one of the knottiest problems in missile history.

It happened this way: About

three weeks before the scheduled launching of a Thor-Able-Star rocket, which was to orbit a Transit all-purpose satellite, the woodpecker landed on the missile's umbilical cable. This is a maze of wires, wrapped in aluminum foil, that supplies power to operate sub-systems in the Thor prior to flight.

"Woody" roamed about the cable, gradually working his way upwards, until he found a cozy niche about 80 feet high in the launch platform. He then began pecking merrily away, and hollowed right into the cable's core.

Air Force officials and missile manufacturers held hurried consultations on how to remove the unwanted tenant. A loud horn failed to disturb the bird. Ringing bells were tried, and seemed not to bother but to soothe him as he pecked deeper into the cable.

Electrocution attempts failed. Discharge of firearms is prohibited at the Cape, so that was ruled out. More consultations were held. Florida Power and Light Company representatives were queried as to what methods they used to keep woodpeckers from boring into their utility poles. They use a mixture of arsenic and creosote, but this was termed inadvisable since it would not adhere to the slippery aluminum surface that wrapped the cables.

Finally, in sheer desperation, engineers devised a special countdown procedure, "Elimination of Woodpecker." A high pressure air bottle was fastened beneath the bird's hole, with a lanyard extending to the missile tower's seventh deck. As Woody unsuspectingly approached his perch for another stint of pecking, the men began their count, 5 - 4 - 3 - 2 - 1, and yanked.

The resulting jet stream of air pressure sent the bewildered woodpecker high into the atmosphere in a southeasterly direction—the same route most rockets take. The bird disappeared from sight and was never seen again. Engineers patched the hole and fired their missile.

Today, visitors at the Cape take a long second look when they tour pad 17-B. On the north side of the stand are stenciled rocket impressions representing successful firings. And, in the upper left hand corner, is a picture of a Red-bellied Woodpecker with a cross beside it—indicative of a perfect launch.

Birds of one form or another plague the Cape. Here, an engineer discovers a nest complete with eggs on top of umbilical mast. One woodpecker nearly managed to peck his way through a similar cable.

So long, Myriophyllum exalbescans

In Florida, they're using sea cows to clear the canals of water lilies that clog the works. But up in the northern lakes, no one has yet found a way to get rid of many prolific water weeds that ruin the swimming and spoil the trout fishing.

Recently, however, a group of *Cornell University* scientists has begun the battle for clear, cool water by investigating several species of common water plants which, unless checked in their growth, eventually may choke to death our lakes and ponds. They hope to determine what makes these plants grow in abundance and to finds ways to curb their spreading.

Prof. Hugh F. Mulligan of *New York State College of Agriculture, Cornell,* has launched a three-year study of four kinds of aquatic plant species; milfoil (known to scientists as *Myriophyllum exalbescans),* curly-leaved pond weed, elodea and coontail. Microscopic algae associated with these plants also are under study.

Water milfoil, Prof. Mulligan points out, has world-wide distribution. Many lakes in Northeast United States are thick with it. The weed grows from the lake bottom to the surface, up to 35 feet long.

Water milfoil, one of most common "weed" species in lakes and ponds in Northeast U.S., and spoiler of swimming and trout fishing, is held here by Prof. Hugh F. Mulligan, who hopes to curb it.

"Excessive growth of any one water plant species can lead to elimination of good game fish, often upsetting environmental conditions," explains Mulligan. "As a result, less desirable fish thrive, among other problems."

The Cornell scientist believes the amount of nutrients such as nitrogen and phosphorous, available in the water, is the key. Sewage and industrial wastes are a source of additional enrichment. Until now, little was known about how these plants grew under different levels of nutri-

ents, natural as well as artificial.

Prof. Mulligan and his aides are transplanting some 10,000 water weeds into 18 experimental ponds, each enriched with tons of rich organic soil to stimulate their growth. At later stages, nitrogen and phosphorous will be added to the ponds to see how the plants respond. The intensity of sunlight in different depths of the water also will be measured to determine light available for the plant to carry on photosynthesis.

With this data, the scientists hope they'll have the secret that will lead to control of the water weed nuisance.

Oldest Reptile

"The oldest reptile known to man" is what two paleontologists have concluded they found eight years ago on a Nova Scotia beach. The foot-long front half of a fossil-skeleton is that of a lizard-like reptile that lived on land some 300 million years ago, or about 25 million years earlier than any reptiles discovered until now.

Princeton University's Dr. Donald Baird and his Canadian colleague, Dr. Robert L. Carroll of *McGill University*, point out that the age of dinosaurs began about 200 million years ago. The new genus and species has been named *Romeriscus periallus*.

Scientists generally agree that life emerged from the water in the form of amphibians some 350 million years ago. It is thought that reptiles then developed from amphibians.

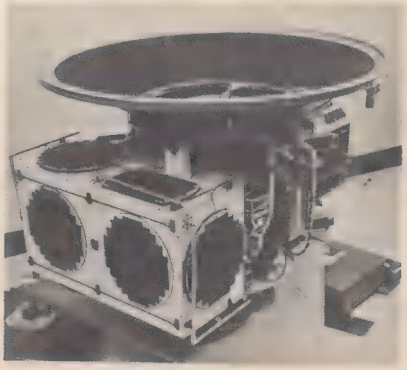
Aurora probes lights

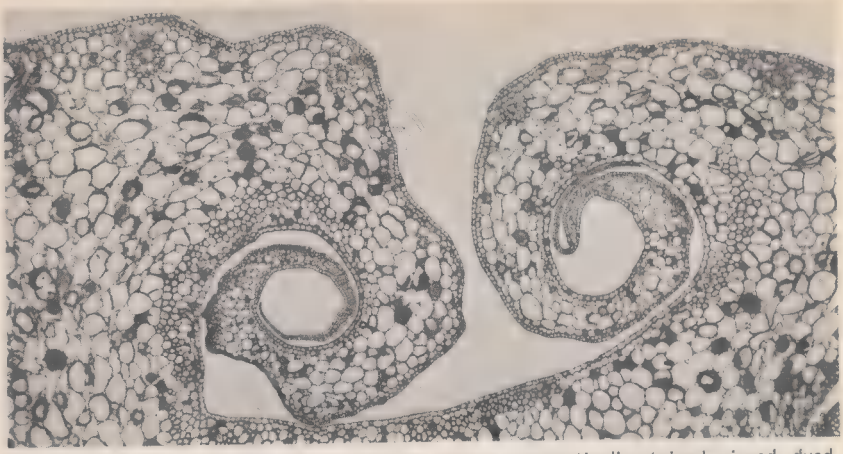
What is the power supply that energizes the bombarding particles from space that trigger the northern lights?

To find out, *Rice University* launched its first satellite last summer in a combined effort with Army, Navy and Air Force. Dubbed Aurora I, it is orbiting some 2,000 miles in space every two-and-one-half hours as it collects data on auroral formations.

Dr. Brian J. O'Brien, professor in space science at Rice, head of the project, explains that since we know the lights are caused by electrons and protons bombarding the earth's

Rice University's Aurora I satellite is shown here in the foreground with an Army SECOR instrument. The combination comprises the payload sent into orbit to collect data on auroral formations.





A sequential cell sectioning process used at Purdue automatically stained, rinsed, dyed, sectioned and photographed, through a microscope, this cross-section of a corn mutant.

atmosphere, the job of Aurora I is to measure the number and intensity of the particles themselves and the light emitted as a result of their collision with oxygen and nitrogen in the upper atmosphere.

Knowledge gained by the satellite may prove significant to projects such as control of fusion reactions. Such control could lead—among other things—to useful electric power by harnessing the hydrogen so plentiful in sea water.

Sequential slice of life

Scientists who investigate the structure of living things say a new sequential cell sectioning process used at *Purdue University* may increase our knowledge, improve our general health, provide more plant and animal foods and change our lives.

Previously, scientists worked with tissue specimens slide by slide. LeRoy Mills, an imaginative film technician in Purdue's Audio-Visual Center, changed all that with his cinematography of serial microscope sections.

The computerized equipment Mills developed consists mainly of a microtome, microscope and camera. The equipment automatically stains, rinses, dyes, sections and photographs through a microscope, either animal or plant tissue. Up to 8,000 specimens can be recorded on motion picture film in 12 hours and played back on a standard projector. The viewer is taken on a "Disneyland" tour of perfect color through the heart of an internal structure. Stop motion can be applied to "freeze" specific frames.

The equipment can trace the steps of differentiation from young to mature regions of a particular organ, making it possible to trace abnormalities to their point of origin.

United Press International

Just another housing development? Yes, but this hoped for Utopian settlement, and others like it, are having far less than the desired effect of lifting dwellers' mental outlook on life.

New town blues

by Flora Rheta Schreiber and Melvin Herman

Two studies on the effects of housing on mental health offer contrasting findings. One, dealing with the residents of new towns that have grown up in Great Britain since World War II, shows that the dreams of the planners of these towns were frustrated. For, although the houses were designed to foster neighborliness and community spirit, their actual effect was to foster "New town blues." Wives complained about loneliness and isolation from friends, families and especially their mothers. Husbands grumbled about having to travel long distances to work. Teen-agers just grumbled. More importantly, the study shows that nervous symptoms and admissions to mental hospitals are more common in these hopefully Utopian towns than in the country as a whole.

The other study is of mental health in a new housing development as compared to that in a nearby older district of the same town. In-depth interviews, examination of doctors' records for mild neurosis and of in-patient and out-patient records for severe cases in a sampling of 1,500—in each town of 15,000—reveals *no important differences in mental health.*

This was equally true for adults and children, and for men and women. It was also true for the ordinary indicators of nervous disorder and for the so-called psychosomatic diseases such as asthma and peptic ulcer.

There was one exception. The proportion of married women com-

plaining of "nerves" and fatigue was somewhat higher in the new development than in the older district. This difference could be explained, however, by the fact that the frequency of such complaints varied directly with the number of children in a family. Larger families were more common to the new development.

The findings of the new study have important implications. Clearly, if mental health remains unaltered by the stress of rehousing and by the social amenities of the district in which one lives, then we must look elsewhere for the causes of mental illness.

The causes would seem to lie in a vulnerability that is either inherited or induced in childhood as a result of either physical or psychological damage. It therefore becomes important to concentrate even more urgently than at present on the health of mothers during pregnancy, on safe childbirth, and on freedom from disease and injury in childhood. What must be explored is the casual relationship between early physical health and later mental health. The value of the new housing developments may yet be realized. The improved physical health of the children who grow up here may lead to improved mental health when the children become adults.

Does your room talk?

Rooms often reveal secrets we prefer to conceal, says William M. Easson, M.D., of the Menninger Foundation, Topeka, Kan. It's especially true of teen-agers. Take a room that is surface-neat only. Underneath it's a mess of disorganized chests of drawers and closets. This may indicate outward calm but inner confusion, according to Dr. Easson. Mirrors and dresser tops full of perfume and make-up often reflect inordinate self-esteem. The general scheme of decoration can reflect the degree of maturity of the person. A usually tidy room may suddenly become messy and cluttered. This may be a clue to anxiety. Adolescents often reveal feelings through the objects they use to decorate rooms. For example, one who is trying to keep from smoking might well frame his mirror with cigarette packages.

A bare and colorless room can reflect that the boy or girl lacks strength to cope with daily life or school. A room can reflect chaos in one's life. A room loaded with pictures of teen-agers' idols or "weirdos" can point to a period of adolescent struggle.

With this point of view, Dr. Easson points out, cleaning day can be a time of discovery for a roommate or parent with a sharp eye. He warns them, however, to keep quiet about what they learn. The average adolescent, he points out—in spite of a horror of confiding uncertainties, loves, hates, hopes and fears—may well be using

this device subconsciously to tell those around what he's really like inside.

"Drinking license, please"

Doctors, lawyers and drivers need licenses. "Why not drinkers?" asks Dr. John D. Boland of Shell Beach, Calif., somewhat sardonically. He proposes that drinkers be issued a license to drink alchoholic beverages—a license that can be revoked temporarily or permanently for misuse. Young people, he believes, should be given beginner's licenses so that, with the full protection of the law and under the supervision of adults with valid drinkers' licenses, they can learn to drink correctly. Those who sell liquor would be required to see an individual's license, which would perhaps make more sense than merely requiring proof of age. The license, morever, could be temporarily voided for simple drunkenness, and permanently voided in the case of drunken driving resulting in a serious accident.

The confirmed alchoholic, Dr. Boland admits, would not be saved by this licensing, but he firmly believes that thousands upon thousands of social drinkers would be helped. The valid drinker's license would also help the policeman, the liquor dealer, the bartender and even neighbors in handling the "happy-go-lucky agent" bent on his own and others' destruction.

Schizophrenic day camp

Noting that male patients who had lived together for many years in the same ward often did not know each other by name, Ruth Wittekin, therapist at the Veterans Hospital in Waco, Texas, had an idea. She decided to lure some of these long-term patients from behind their schizophrenic barriers. Accordingly, she arranged a five-day "camp-by-day" program.

Twenty-four long term patients in a deep state of regression joined the camp. To further a feeling of acceptance and belonging, the men were then divided into five different Indian tribes. The tribes cooked, formed scouting parties, fished, worked at nature crafts and played original games. They also indulged in competitive games and helped plan menus.

The response was heartening. Poor appetites improved in short order. Indifferent eaters became ravenous. Late risers became early risers, impatient to leave for the campsite. The men brought their own steaks to gain a feeling of sharing. They cooked the steaks over stoves they themselves had built. With a newly awakened sense of group spirit, they competed for points for their own group and kept a scrapbook of their groups' exploits.

Once the first camp had become an unqualified success, two more camps followed. One camp had a cowboy theme and the other took an imaginary five-day tour of old Mexico.

Barber shop phobia

Psychiatry has turned up a completely unexpected reason for the long-haired generation of males: They may all suffer from "barber shop phobia." Surprisingly, this is a very real disease reported by a number of psychiatrists, and most recently by Dr. Ian Stevenson, chairman of the Department of Neurology and Psychiatry, University of Virginia Medical School.

This doctor recounts the story of a 35-year-old man with a variety of psychoneurotic complaints, including a severe phobia of barber shops. This man frequently lets his hair grow long by postponing as long as possible the inevitable visit to his hair-cutter.

Curiously, however, once our hero finally does get himself in the barber's chair, he feels no anxiety. This is because he, along with his younger long-haired colleagues, avoid the barber shop not through fear of having their hair cut, but to rebel against conformity. Recalling that as a child he had submitted to having his hair cut while his parents forcibly held him on a stool, he rebels against barbers in loco parenti.

There are other forms of the same phobia. One 53-year-old man was afraid once inside the barber shop, although not beforehand. His fear centered around not being able to get away once in the chair. With the towel around his neck, he felt as if he were the barber's prisoner.

Barber shop phobia is not merely claustrophobia. Many persons afraid of small, confined places, are not afraid of barber shops. Many persons afraid of barber shops do not fear the confined area, but the barber's scissors.

Perhaps the fear of the scissors is justified. Some barbers, Dr. Stevenson reports, choose this vocation because it affords them an opportunity to cut people——in fantasy. One barber, for instance, saw his doctor because of obsessional fears of cutting his cutomers while shaving them.

Whatever form the barber shop phobia takes, it becomes menacing because of remembrances of things past. "The barber shop," says Dr. Stevenson, "obviously presents no real danger. It becomes clear that the patient must have experienced anxiety in some earlier situation which contained stimuli similar to those he now finds in the barber shop. The psychiatrist's job is to discover what the original experience was."

Right from wrong

As every TV viewer and moviegoer knows, the best way to commit murder and get away with it is to have a psychiatrist declare that at the time the crime was commit-

Miss Schreiber is an award-winning writer on psychiatry; Herman, the Executive Secretary of the National Association of Private Psychiatric Hospitals.

ted you didn't know right from wrong. At least this used to be the way. Now, however, two University of Georgia investigators, Joel Robert Butler, Ph.D., and John Trice, M.D., along with Karen Calhoun of Louisiana State University, have uncovered evidence that may make getting away with murder more difficult. The findings, made possible by a grant from the Louisiana State Department of Hospitals, show that *psychotic patients know and understand as well as normal individuals that murder is morally and legally wrong.*

The study, which involved putting 12 questions to 678 persons, ranging in age from seven years to adulthood, clearly demonstrated that people in mental hospitals do know right from wrong. The only significant difference between normal and abnormal persons, according to the study, is that the psychotics cherish the starry-eyed notion that almost everybody knows right from wrong, whereas fewer normal persons have such illusions.

Therapeutic farm hands

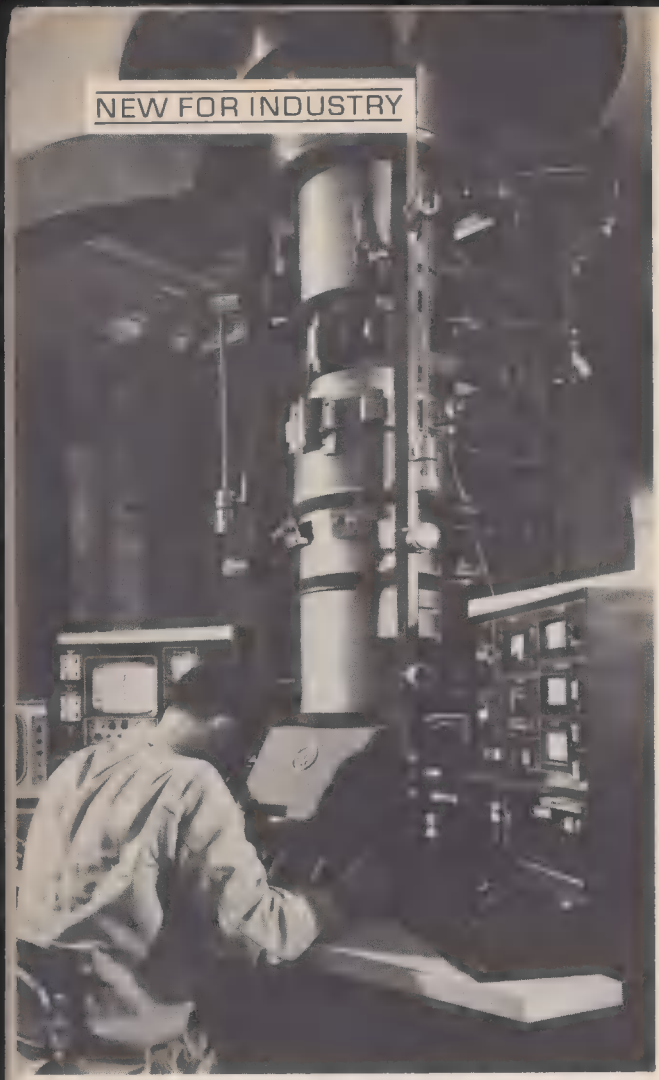
"A psychotherapist who limits himself to verbal methods is like a football coach who only has individual interviews with the players and never sees them playing together," says F. Knobloch, M.D., of the University Polyclinic in Prague, Czechoslovakia.

To study patients not only in terms of what they say, but also how they behave in the course of a broad range of activities they must encounter in life, Dr. Knobloch and his colleagues have set up a "neurosis center" outside Prague. Living together on a state farm which they operate under their own self-government, patients work a six-hour day as farmers or foresters, jobs that are wholly new to them. Under the stresses and frustrations these unfamiliar jobs impose, the patients reveal their capacity for adaptation in the family-like relations that emerge.

The program is part of the Czechoslovakian national health service and is free to all citizens. In the program, which has been in operation since 1949, group therapy has emerged from earlier experiments in which Dr. Knobloch and his colleagues dealt with patients in the groups in which they functioned, starting with the family. "Individual psychotherapy of long duration as a first step is a waste of time," says Dr. Knobloch. The emphasis, however, is on "long duration." Far from discarding individual therapy, the doctor believes that "only by a planned combination of different group and individual methods can maximum efficiency in therapy be achieved."

At first, people were averse to hospitalization. But they now see, Dr. Knobloch says, that "a small therapeutic community can become one of the best tools for personality diagnosis and psychotherapy.

NEW FOR INDUSTRY



United States Steel's one-million volt electron microscope (above)—the most powerful ever developed for commercial use—can reveal the internal structure of matter on ■ scale equal to atomic dimensions. Studying enlarged images on viewing screen, the steel firm's microscopists hope to find stronger, lighter and more durable alloys for the space age.

This greenhouse (right) of such unique configuration is called a Life Sciences Laboratory at the Rock County Extension Center of the University of Wisconsin. The all-glass structure was designed for biology and botany classes and manufactured by Lord & Burnham, Irvington-on-Hudson, N.Y. Iron pedestals lift dome greenhouse above ground.

Push-button TMI Cloud Maker (left) provides controlled volumes of clean dry smoke for wind-tunnel study of air frame or motor car design, probing aero-dynamics, testing the air flow patterns in any area or building. Built by Testing Machines, Inc., Amityville, Long Island, N. Y.

Handless clock, map (below) divided into 24 equal parts and electronics combine to give correct time anywhere in world. One locates city on map, follows line down and presses corresponding button at bottom of map. Local time flashes off and the sought time appears in lights on the clock face.

Australian News and Information Bureau

Magnesium-air battery (right) can be refueled in about 15 minutes by adding new magnesium plates, salt and water. G.E. claims new power source packs more energy per pound than most conventional batteries.

Note water droplet on disk and area to right where absorption took place. Part of disk where water remains was treated with G.E.'s new tetra fluoro-ethylene (TFE), which prevents water absorption by filter paper.

MEDICINE

Nervous habits are assets

by Arthur J. Snider

It may be annoying to others, but the nervous habits of students at study have the approval of a physician. Hair-twirling, leg-jiggling, nail-biting, nose-picking, skin-pulling and other idiosyncracies indulged in while deep in thought are an aid to concentration, he says.

They're all a means of releasing inner tension drives that might otherwise interrupt the cerebral process, Dr. William S. Appleton of Boston points out.

Concentration is one of the most isolated activities one can engage in.

It means cutting out all other sensory input. Sensory deprivation studies have shown that the human organism is unable to tolerate extended periods of inactivity. Man hungers for stimulation and change.

"Monotony and boredom can be as painful and damaging to the individual as trauma," Dr. Appleton says. Therefore, many students combine concentration and sensory stimulation by studying in a library. They may interrupt their roommates at intervals. Many students play loud records, the radio or television while studying—to the dismay of their parents.

Dr. Appleton finds nothing wrong in the practice if it helps get the work done. He also approves of the "study date." While adults may regard these as a way of socializing, the physician finds the main purpose is the wish for physical presence of another human being.

Dr. Appleton became interested in the phenomenon of concentration because learning and work disabilities are among the most common complaints brought to his office at Harvard Medical School. Many of the students admit an inability to concentrate. Currently, he is interested in studying concentration habits of great thinkers in contemporary society.

Sustained concentration, he says, is difficult for anyone unless the subject under study is intensely interesting or the motivation to study is strong. Thus, at examination time students concentrate (cram) much better than at other times.

"Some students, idle all term, rise to remarkable heights of endurance and concentration," he notes.

Hope for flat-chested

With the exception of Twiggy and the Roaring Twenties, when the flat chest was in vogue, the contour of the female breast has been glorified in paintings and sculpture. The emphasis on the shapely bosom has driven many less-endowed women to doctors in search of help. For decades, bust-builders have had little to offer. They have inserted small glass balls, plastic wool, ox cartilage, various kinds of plastic sponges. None proved successful. The implants either were not well tolerated or were resorbed. Some even proved to be cancer-producers.

But now cautious optimism is beginning to surround use of a synthetic rubber material, silicone. A report recently issued by a national study committee is guardedly favorable. More than 40,000 American women have had breast implants using silicone, estimates Dr. Milton Edgerton of Johns Hopkins Hospital.

Silicone implants were developed in 1960 after the material was made available by the Dow Corning Center for Aid to Medical Research at Midland, Mich. The material is inert and non-irritating. But the unresolved question in the minds of many doctors is the cancer-producing potential in placing a foreign material into an organ that has a special propensity for developing cancer.

While approving silicone implants, the Food and Drug Administration forbids use of silicone injections, a practice that has developed in the Los Angeles area as go-go girls in discotheques seek to increase their measurements. Not enough is known about the ultimate fate of the fluid. In some cases it has accumulated in lumps.

Healthy coffee breaks

Nutrition experts are ready to surrender to the great American coffee break craze. They are willing to recommend vitamin-enrichment of doughnuts, cookies and pastries.

For years the authorities have resisted such a move on the ground that it would encourage consumption of obesity-producing, dental-wrecking sugars. But they have been unable to discourage consumers. Purchasers of sweet baked goods have increased 65 percent in the last 10 years.

Dr. Robert Harris of Massachusetts Institute of Technology believes serious consideration should now be given to fortifying sweets. He conceded it may promote even greater consumption by the mid-morning army of snack-grabbers, but at least they would be getting more than empty calories.

Dr. Harris points out that before white bread was enriched 25 years ago, the same conclusion was reached about it. For years nutritionists opposed the move, hoping to encourage the use of whole wheat bread. But when the public went on eating white bread, the enrichment program was started.

"People have to be protected against themselves—against their follies," Dr. Harris explains. "The mass of people will eat what they want. If you tell them it isn't good for them, they will not pay attention."

Asbestosis: prickly hazard

Asbestos is part of our civilization. It is used in textiles, tile, cement products, friction materials, paper, paint and plastics, and it has 3,000 other specific uses.

But this fibrous material has a tendency to subdivide continually into tiny particles that can be breathed into the lungs to cause asbestosis, which can be fatal after many years. Asbestosis also is suspected of increasing lung cancer. Not only asbestos miners and those who work in manufacturing with the material may be affected, but there are strong indications it may also be an urban hazard.

Dr. Nicholas G. Demy of Somerville, N.J., points out in the "American Journal of Roentgenology, Radium Therapy and Nuclear Medicine," there is no wash away effect once the fiber has become embedded in the tissues. It will only fragment into submicroscopic particles.

They recorded 47 patients with cancer believed to result from asbestosis. Most had exposure to asbestos from 15 to 25 years.

Signs of asbestosis have been found in persons living near plants where asbestos is used.

Off with tattoos

The intensely hot laser light beam has been used successfully at the University of Cincinnati department of dermatology to remove tattoos usually treated with considerable effort by surgery and grafting, by planing off layers of the skin and by obscuring the color through cautery.

Dr. Leon Goldman said the laser is an ideal instrument for tattoos and purplish birthmarks because it is selectively absorbed by darkly-pigmented skin. The light beam vaporizes the tissue on contact. Some charring and crusting results at the outset. After the crust peels off, a flat reddened area remains. The redness begins to fade in 3 or 4 weeks. After a year, only a smooth white scar remains.

Feed baby fashionably

Three national surveys during the last 20 years have shown a decline in breast feeding as a fashion. The first study in 1948 found 35 percent of babies were bottle-fed following

discharge from the hospital. Thirty-eight percent were breast-fed and 27 percent were both breast- and bottle-fed. Ten years later, a survey showed 63 percent discharged on bottle feeding, 21 percent being breast-fed and 16 percent on both breast and bottle. In 1961, a survey showed 70 percent of babies were bottle-fed only, 24 percent breast-fed and six percent were on breast and bottle.

In noting the unfashionable practice of breast feeding, Dr. Eva J. Salber of Harvard School of Public Health, Boston, said nursing is least prevalent in the northwestern region of the United States. However, there has been an interesting reversal among the higher social classes who introduced the fashion of bottle feeding. They now breast feed more than lower class mothers. Perhaps they have been influenced by modern psychiatric teaching, Dr. Salber reasons.

Whether the lower socioeconomic classes will again follow the pattern will depend largely on the attitudes and teachings of medical and nursing professions, she adds. The decision for or against breast feeding is greatly influenced by the hospital in which the woman delivers and by her doctor.

Appendicitis still kills

In an era of heart operations and kidney transplants, appendicitis is not a very glamorous disease, but it is still causing "awesome and tragically unnecessary deaths." The reason, says Dr. Paul F. Nora, chief of surgical services at Chicago's Columbus Hospital, is delay in operating, particularly on those over 50.

One thousand consecutive cases of acute appendicitis admitted to the hospital over a 4½-year period were reviewed. Thirty-one percent of those in persons over age 50 had progressed to gangrene or perforation by the time they had reached the operating table. The frequency of these complications doubled in patients not operated on in the first 24 hours after admission. Of the 14 patients who died, only one had been operated on the first day in the hospital.

Ninety-five percent of patients had contacted their personal physician within 36 hours after onset of symptoms and were in the hospital within 48 hours. "This represents an impressive degree of awareness on the part of the general public and is probably the result of a long campaign of public education," said Dr. Nora. "Nevertheless, we find that after admission only 275 were operated on during the first day."

Most prominent reason for delay was the uncertainty of diagnosis, particularly in the older age group in whom other diseases such as gastroenteritis are common. The second most common reason was an attempt to abort or reverse a strongly suspected or even certain case of appendicitis with antibiotics. While antibiotics can be helpful after complications have occurred, Dr. Nora believes there is no evidence they

can resolve an early or uncomplicated case of appendicitis.

Teen exercise vital

A lack of physical activity and sports in childhood and teen years is a major factor in the backache that develops in many young women during pregnancy.

Dr. Evalyn S. Gendel of the University of Kansas medical center reviewed the cases of 35 women and

found they did not participate in team or individual sports during the school years and in no calisthenics or other regular physical exercise through junior high school years or since marriage. None had ever ridden a bicycle. Only one or two cared about dancing. None were walkers. None were bowlers, skaters, golfers or engaged in any leisure exercise programs.

Some of the fault relates to the myths that have surrounded physical activity for women, Dr. Gendel believes. Exercise has no relation to onset of menstruation nor does it affect it in any way, she says.

Stiff knee a relief

Some persons with arthritis of the knee suffer so much pain that only a surgical stiffening can relieve it. But how happy are patients who undergo such an operation? Among a group of 124 persons who agreed to the operation, only two are displeased with the permanent stiff leg, a New York doctor says.

The majority of persons with a fused knee avoid public modes of transportation, particularly subways and city buses, because of the annoyance of having others stumble over the leg, Dr. David P. Green of New York Orthopedic Hospital found in his survey.

Driving a car does not pose any particular problem, especially for the patient with a fused left knee who is able to handle an automatic transmission with ease. Several patients with fused right knees converted their automobiles to hand controls and did well.

Theaters are infrequently attended unless the patient is assured an aisle seat, Dr. Green reports. While housework presented special problems when low places needed cleaning, many patients developed remarkable flexibility in the hips and spine.

Dr. Green recommends that fusing of a knee should not be considered unless pain is severe to the point of disability. In that case, he adds, almost any patient is willing to trade the pain in a more or less flexible knee for the inconvenience of a stiff knee.

Each month Dr. Isaac Asimov chooses one of the questions you send in to answer. He does not make the job easy on himself, for in past months he has written about such things as relativity, parity and the basic nature of light. Following Dr. Asimov's answer are the answers to some of your other questions written by regular members of the **Science Digest** staff.

The thinking machine

What is the difference between a brain and a computer? Can a computer think?

The difference between a brain and a computer can be expressed in a single word: complexity.

The large mammalian brain is the most complicated thing, for its size, known to us. The human brain weighs three pounds, but in that three pounds are ten billion neurons and a hundred billion smaller cells. These many billions of cells are interconnected in a vastly complicated network that we can't begin to unravel as yet.

Even the most complicated computer man has yet built can't compare in intricacy with the brain. Computer switches and components number in the thousands rather than in the billions. What's more, the computer switch is just an on-off device, whereas the brain cell is itself possessed of a tremendously complex inner structure.

Can a computer think? That depends on what you mean by "think." If solving a mathematical problem is "thinking," then a computer can "think" and do so much faster than a man. Of course, most mathematical problems can be solved quite mechanically by repeating certain straightforward processes over and over again. Even the simple computers of today can be geared for that.

It is frequently said that computers solve problems only because they are "programmed" to do so. They can only do what men have them do. One must remember that human beings also can only do what they are "programmed" to do. Our genes "program" us the instant the fertilized ovum is formed, and our potentialities are limited by that "program."

Our "program" is so much more enormously complex, though, that we might like to define "thinking" in terms of the creativity that goes into writing a great play or composing a great symphony, in conceiving a brilliant scientific theory or a profound ethical judgment. In that sense, computers certainly can't think and neither can most humans.

Surely, though, if a computer can be made complex enough, it can be as creative as we. If it could be made as complex as a human brain, it could be the equivalent of a human brain and do whatever a human brain can do.

To suppose anything else is to suppose that there is more to the human brain than the matter that composes it. The brain is made up of cells in a certain arrangement and the cells are made up of atoms and molecules in certain arrangements. If anything else is there, no signs of it have ever been detected. To duplicate the material complexity of the brain is therefore to duplicate everything about it.

But how long will it take to build a computer complex enough to duplicate the human brain? Perhaps not as long as some think. Long before we approach a computer as complex as our brain, we will perhaps build a computer that is at least complex enough to design another computer more complex than itself. This more complex computer could design one still more complex and so on and so on and so on.

In other words, once we pass a certain critical point, the computers take over and there is a "complexity explosion." In a very short time thereafter computers may exist that not only duplicate the human brain —but far surpass it.

Then what? Well, mankind is not doing a very good job of running the earth right now. Maybe, when the time comes, we ought to step gracefully aside and hand over the job to someone who can do it better. And if we don't step aside, perhaps Supercomputer will simply move in and push us aside.

—Isaac Asimov

What is the Iguanodon?

The Iguanodon has the distinction of being the first dinosaur to be identified. A fossil tooth of the creature was discovered in March 1822, by the wife of Dr. Gideon Mantell, an English physician and man of wide scientific interests.

The doctor began digging on the site of the find and uncovered more teeth and some large bones. All these remains were unfamiliar to him, so he consulted others.

Experts first identified the teeth as those of an extinct rhinoceros and the bones as those of a hippopotamus, but Mantell would not accept these identifications.

A few years later he met a naturalist who had been studying the Iguana, a large South American lizard. This naturalist saw immediately that Mantell's fossil teeth resembled those of the Iguana, but they were much, much larger. Man-

tell dubbed his creature *Iguanodon,* which means "Iguana tooth".

The first world's fair was the Crystal Palace exposition held in London in 1851. One of the chief attractions of the exposition was a life-sized restoration, in concrete, of Iguanodon. Although the reconstruction was made with the aid of the best scientific knowledge available at the time, we now know that it was wildly inaccurate.

As it appeared at the Crystal Palace, Iguanodon was a rhinoceros-like reptile with a horn on its nose. In truth, Iguanodon was more bird-like, walking upright on two legs. The "horn" turned out to be a large spike that formed the end of the beast's thumb.

"But we need not criticize the Crystal Palace models because of our superior modern knowledge," says Dr. Edwin H. Colbert of the American Museum of Natural History in his book "Dinosaurs". "They were laudable and sincere efforts for their time and they were most effective. A century later they are still standing." Most important, they brought the concept of dinosaurs to the general public.

Before the model was completed, the builder summoned a group of distinguished scientists to what must be one of the most unusual dinner-parties in all history. The notables at the party sat at a table inside the model, while the less favored were relegated to tables set up around the reconstructed dinosaur. Says Dr. Colbert, "it was a memorable affair."

Advertisement

Suddenly I Lost My Memory!

A noted publisher in Chicago reports there is a simple technique for acquiring a powerful memory which can pay you real dividends in both business and social advancement and works like magic to give you added poise, necessary self-confidence and greater popularity.

According to this publisher, many people do not realize how much they could influence others simply by remembering accurately everything they see, hear, or read. Whether in business, at social functions or even in casual conversations with new acquaintances, there are ways in which you can dominate each situation by your ability to remember.

To acquaint the readers of this publication with the easy-to-follow rules for developing skill in remembering anything you choose to remember, the publishers have printed full details of their self-training method in a new book, "Adventures in Memory," which will be mailed free to anyone who requests it. No obligation. Send your name, address, and zip code to: Memory Studies, 835 Diversey Parkway, Dept. 690-01D, Chicago, Ill. 60614. A postcard will do.

QUIZ

What's new on the moon

by John and Molly Daugherty

THE first American team of two men to land on the moon will stay less than a day—probably about 18 hours. The plan calls for one such mission a year, starting in 1970 or 1971. Who knows to what future adventures moon exploration will lead us?

What do you know about the moon's potential value to man?

1. If you were on the moon, even on a diet, three full meals a day would
   a. Cause you to gain weight
   b. Not be enough to sustain you
   c. Affect you the same as on earth

2. On the moon you would have to be protected from heat and cold. The temperature difference between day and night is about
   a. 320° F
   b. 530° F
   c. 730° F

3. As dismal as the moon's surface is, it is an environment where
   a. Freeze-drying of food would be cheaper and more effective than on earth
   b. Linseed oil house paint would harden quickly
   c. Water would boil at a higher temperature to cook faster

4. Research indicates that the high degree of vacuum on the moon would be most important in the area of
   a. Materials research
   b. Thin-film industry
   c. Metallurgy

5. In vacuum technology the torr is 1/760 of a standard atmospheric pressure. A typical vacuum tube may be evacuated to one-millionth of a torr (.000001 or 10^{-6}torr). We have attained greater vacuums. The vacuum on the moon is probably
   a. 10^{-4}torr
   b. 10^{-10}torr
   c. 10^{-14}torr

6. On the moon, electron tube research would
   a. Need heavier glass enclosures to keep tubes from exploding
   b. Be enhanced by the ease of parts adjustments and the freedom from contamination
   c. Require more time in experimental adjustment

7. The moon may be a wonderful place to build a hospital for
   a. Cardiac patients
   b. Diabetic patients
   c. People with pulmonary diseases

8. If you look at the stars through a telescope on the moon, you
   a. Could see the stars only at night
   b. Would have a disadvantage without air to diffuse light
   c. Would be able to see stars (except when looking directly at the sun) day and night

9. An analysis of lunar rocks made by Surveyor 5 shows that the moon's surface of rock is
   a. Granite
   b. Basalt
   c. An unusual mixture of rock

10. If you'd hit your golf ball on the moon with the same force you'd use on earth, your drive would
   a. Go an equal distance as on earth
   b. Set the ball in orbit around the moon
   c. Cover a much greater distance than it would on earth

Answers:

1—b Not be enough to sustain you. Day lasts two weeks on the moon; night, two weeks also. The moon takes about four weeks to rotate on its axis. The earth takes 24 hours. If you should eat breakfast on the moon at sunrise, it would be a whole week till your next meal if you'd eat at noon.

2—b 530° F. Day temperatures are probably 260° F, and night, about —270° F. Re-radiation from the moon's mass keeps temperatures from falling much lower than —270° F (about 105° Kevin). The temperature of +260° added to —270° makes the difference between low and high temperatures 530° F.

3—a Freeze-drying of food would be cheaper and more effective than on earth. The low temperatures at night eliminate the need for freezing equipment, and the lack of air and moisture ensures a product that is really dry. On earth any residue of moisture in food cuts down on the length of time the food will keep. Linseed oil needs oxygen to harden.

4—a Materials research. Seventy-five percent of scientists in a survey of the American Vacuum Society said that the environment on the moon with the high vacuum available would enhance their kind of research. Thin-film was second—51.5 percent, and metallurgy, third—48 percent.

5—c 10^{-14} (or .00000000000001 torr). And this would be free—we'd need no vacuum pumps. There are many research and manufacturing processes that require a high degree of vacuum. The costs of the necessary equipment are high. On the moon there would be no space limitations for a vacuum laboratory.

6—b Be enhanced by the ease of parts adjustments and the freedom from contamination. In the near-perfect vacuum of the moon, without the need for a glass enclosure, we could make direct and immediate adjustments of electron tube parts. Without air, no contamination which interferes with electron flow is probable. We'd need simple shades to shelter parts or keep them cool unless we'd use cave locations.

7—a Cardiac patients. With the reduced gravity on the moon, a 180-pound man would weigh only 30 pounds. It would be easier for people with infirmities to move about on the moon. With every step you take on earth, you partly lift your body against gravity. Walking on the moon would put less strain on your body, especially on your heart.

"Got 'im!"

8—c Would be able to see stars, except when looking directly at the sun, day and night. Without atmosphere on the moon to diffuse the light, the sky is dark in daytime. The sky would be dark, and you would see stars except when you'd look toward the sun.

9—b Basalt. It is the most common volcanic rock on earth. This tends to upset the theory that the impact of meteors formed the valleys on the moon. It supports the idea that the moon was once hot and similar to the earth. Atomic analysis indicates that the percent of oxygen and silicon in the moon's crust is like that in the earth's.

10—c Cover a much greater distance than on earth. Because gravity on the moon is only about one-sixth as great as that on earth, the time of flight horizontally would be about six times longer. This does not include the fact that the ball would probably soar to a greater altitude. Of course, there is no air friction. In fact, your caddy might not be able to find your ball!

Score yourself:

9—10 right—Your score is sky high!

4— 8 right—Moonlight more at the library.

0— 3 right—You've been mooning.

A sane look at myths

Myths of the Space Age, Daniel Cohen. Dodd, Mead & Co. ($5.95)

We like to think of ourselves as living in a scientific age, with the days of superstition, belief in magic and fear of witches and demons forever behind us.

This is not so, of course. We merely flatter ourselves. The world is still hagridden by magic and myth, and this is true not only among the backward and uneducated people of the "underdeveloped nations," but among ourselves as well. The belief in all sorts of foolish fantasies reaches right into the proudest universities of the most advanced nations and is argued over heatedly at the very highest intellectual levels.

Indeed, science has spawned a set of myths of its own—pre-scientific fables, newly clothed in all the formidable terminology of physics and astronomy and, in some cases, trimmed with the exotic symbols of mathematics as well. Daniel Cohen bravely and capably tackles these in his well-titled *Myths of the Space Age*.

The word for the book is "sane." It is a cool and civilized look at views that border and sometimes pass the edge of the ridiculous. It is a gentle, non-polemical, rational and amusing account of some of the popular intellectual fads of the day. It is well-written and absorbing. But above all, it is sane.

If you have ever been exasperated by someone's firm belief in some taradiddle, here is the book that will give you the ammunition with which to answer sanely. If you have ever been tempted yourself to accept something which seems exciting and attractive even though far-out, read this book before committing yourself entirely.

Mr. Cohen is fair. He gives you all the information available on ESP, for instance, and carefully lays it on the table for you, with no heavy-handed editorializing though his own skepticism is plain to see.

In the spate of books on flying saucers, ranging from earnest enumerations of endless newspaper accounts in order to prove that "something is going on," to red-hot insistence that flying saucers are even now "taking over," it is comforting to read Mr. Cohen's quiet analysis, placing all the UFOlly in perspective.

Mediums are amusingly dissected; and the ridiculous *Search for Bridey Murphy,* which raised such a fine fuss in the 1950s, is carefully revealed for what it was —a piece of nonsense, and not even a clever piece.

My favorite chapter, though, is the one on Immanuel Velikovsky. I remember the initial flurry in 1950, when his book *World in Collision* first appeared, claiming that Venus shot out of Jupiter in 1500

B.C., narrowly missed the earth, caused the plagues of the Exodus, stopped the earth's rotation in time for Joshua, etc., etc., etc. It was widely acclaimed as a case of "Science proves the Bible!" in the headlines. Excitement died down quickly enough, but the recent discovery of Venus's unexpectedly high temperature threatens a revival. It is good, therefore, to have the matter placed in context and the complete Velikovskian dogma (as presently revealed) spread out in all its fine madness.

Naturally, we can be sure that Mr. Cohen will not singlehandedly stop these myths and return all the high-flying specimens of *Homo crankus* to earth. The crank, alas, is immune to reason. However, we are not all cranks, and those of us who are rational can ask for no finer guide to the currently irrational than is contained in *Myths of the Space Age.* —*Isaac Asimov*

Other new books of interest

Space Frontier. Dr. Wernher von Braun. Holt, Rinehart and Winston, Inc. ($4.95). The director of NASA's George C. Marshall Space Flight Center answers questions concerning various aspects of space flight today.

Grey Seal, Common Seal. R. M. Lockley. October House Inc.

From the land of Hy-dud-dye-fee

The Snouters: Form and Life of the Rhinogrades. Harald Stumpke (Gerolf Steiner). Natural History Press. ($3.95).

Pictured at left is Haeckel's Primitive Snouter. It merely stands on its nose while eating. The Snout Leaper has a pointed nose adapted for jumping, while the fabulous Earwing flies with its ears and lands on its nose. All of these remarkable creatures and many, many more live on the island of Hy-dud-dye-fee, part of the Hi-yi-yi archipelago, which is located right in the middle of one of the most delightful scientific spoofs of all times. *The Snouters* won't become a classic—it already is.

(\$7.95). More than just a natural history of seals, this book also shows the intelligent, fascinating and happy side of this favorite mammal.

He and I and the Elephants. Bernhard Grzimek. Hill and Wang, Inc. (\$5.00). The wildlife of the Ivory Coast and a tribe called the Baule have been captured in writing and photographs from Dr. Grzimek's past expeditions.

So Excellent a Fishe, A Natural History of Sea Turtles. Archie Carr. Natural History Press. (\$5.95). The sea turtle and its amazing migration from feeding grounds to place of birth to nest (over 1,400 miles of ocean with no "landmarks") is the story this professor of biology has to tell. Dr. Carr has studied the sea turtle for years (*Science Digest*, Sept. 1967) and is a leading authority on the animal.

Non-Human Thought. Jacques Graven. Stein and Day. (\$5.95). The first in a new series, Boundaries of Knowledge, deals with facts and implications that animals, even the lowest forms, make certain decisions that involve thought.

Books About Ants: *The Ant Realm. Ross E. Hutchins. Dodd, Mead & Co. (\$4.50). Ants From Close Up. L. Hugh Newman. Thomas Y. Crowell Co. (\$6.95)*. Both books, which are illustrated, delve into the lives and social activities of this most prevalent of insects.

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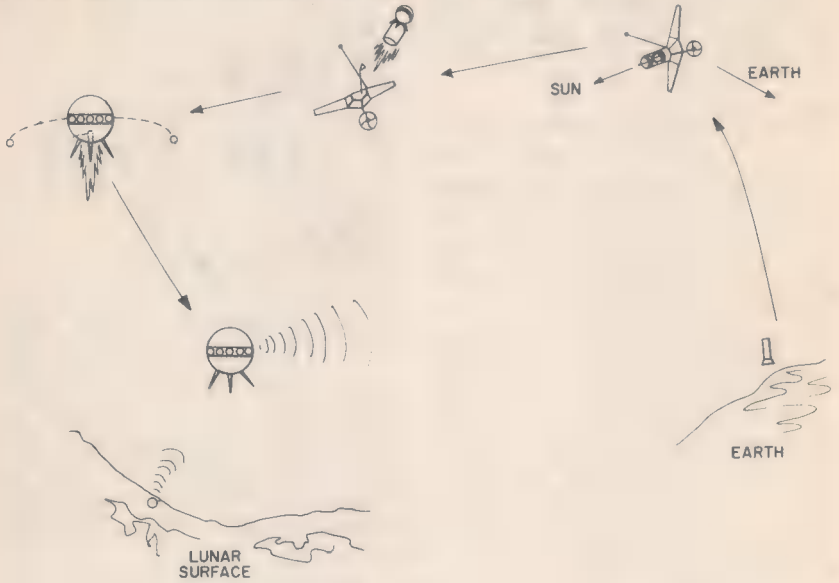
Idea of the month:



Soil probes for space

ENGINEERS at the Langley Research Center in Virginia have invented for the space agency a system for testing the surfaces of distant planets with spherical penetrometers. Scattered from a spinning carriage, the penetrometers may be used to send back reports of conditions on Mars or Venus.

The carriage, or probe, can be released toward the planet from an orbiting spacecraft such as a Mariner. A patent (No. 3,339,404) recently granted the engineers shows a ring of 16 penetrometers arranged to be spun off, four at a time, from an altitude of more than a mile. They are designed to scatter over an area 2,000 feet across.

Each of the globe-shaped instruments has an omnidirectional accelerometer to register the hardness, bearing strength and penetrability of the rocks, dust or mud on the planet's surface. The radio reports from the penetrometers can be relayed by the carriage to a ground station, where they can be compared with characteristics of dirt and stones on the earth.

The three engineers—George W. Brooks, John L. McCarty and Alfred G. Beswick—designed the system for the National Aeronautics

and Space Administration to use in planning the lunar landings of its manned Apollo flights. It proved to be unnecessary on the moon in view of the excellent pictures sent back by the Surveyors. Surveyor V made a soft landing Sept. 10 and added its reports to previous data.

For distant planets, the light penetrometers would presumably be more practical than the relatively heavy Surveyor craft.

Mariner V, which was launched June 14, was scheduled to be close enough to Venus Oct. 19 to get data on that planet's atmosphere. Its predecessor, Mariner IV, took photographs of Mars in 1965 and is still in orbit. Another flight to Mars is set for 1969. —*Stacy V. Jones*

Japanese electric auto

One of Japan's leading electrical firms has developed a transmissionless electric automobile capable of speeds up to 62 mph. The Tokyo Shibaura Electric Co., Ltd (Toshib) says the auto is powered by a revolutionary high-performance electric motor developed at the company's research lab. An outstanding feature of the power system, according to the manufacturers, is that during periods when the motor is not used for propulsion—for example, when braking or traveling on a downgrade —the motor automatically becomes a generator and recharges the batteries while the vehicle is in motion.

Efficient desalting

A new seawater desalting plant that promises to make possible substantial reductions in the cost of desalting was opened recently in San Diego, Calif. Built by Aqua-Chem, Inc., of Waukesha, Wis. the one million-gallon-per-day plant will operate with twice the efficiency of any seawater desalting plant now in operation anywhere in the world, producing twice as much water for every pound of steam required to heat the seawater to evaporation temperatures. According to Aqua-Chem officials, the new design technology will be utilized in the design and construction of the nuclear-powered 150 million-gallon-per-day plant now planned by the Metropolitan Water District of Southern California.

Mufflers for jets

A porous fiber metal material, sold under the trademark Feltmetal, is being installed in some jet aircraft to reduce the problem of noise near airports. The stainless steel absorbent liner, which weighs less than one pound per square foot, has been found to reduce the noise output of the engine under some conditions, with most of its effectiveness concentrated in the high frequency sound region. The fiber metal liner is made from stainless steel fibers which are felted into large, uniform sheets. The material is manufactured by Huyck Metals Co., a division of the Huyck Corp., 45 Woodmont St., Milford, Conn.

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Special publication

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After I've read most of its contents I send it to my cousin in California who is a passionate student of scientific material.

Please accept my congratulations.

JOSEPH MANGANO
Brooklyn, N.Y.

Is it moral?

I would like to take issue with Dr. Pendleton (Underground A-Tests May Be Making Us Radioactive, Sept. '67). Does he mean to say that it is morally right to subject people to dangerous radiation if it is in the national defense interest? I would rather see people dying for the advancement of mankind, than for actions which tend toward barbarism. This is not to say that the loosing of this radiation is in any way justified. A death of this sort "for national defense" is not morally justified. Defense really means preparation for a

possible war. I don't think anyone will say that war is morally right.

I hope that Dr. Pendleton merely used bad phrasing. I do agree that the radiation should be eliminated (if such a small amount is dangerous).

GLENN NELSON
New Hyde Park, N.Y.

Not a navy man

I hope the author of "New look for the navy" (Science Month, Sept. '67) was not a navy man. Any self-respecting navy man would certainly know that a knot is a rate of travel equal to one nautical mile per hour. Therefore, to say "40 knots an hour" is an unadulterated redundancy!

C. E. RUGE
Barrington, Ill.

Three professions

First let me say that I enjoy *Science Digest* very much and this letter is not to criticize, but to point out an error in an article in your September issue. The article "Here's Looking at You" states that, "Variable prisms enable the optician to determine the required prismatic correction for certain abnormalities—etc." Since opticians are technicians and are qualified only to fill optical prescriptions of the optometrist and ophthalmologist, this statement is in error.

For your information, the optometrist is trained and equipped to examine the eyes to determine the proper prescription needed for correct vision and also to determine pathology of the eyes by means of (1) scoping—not only does this reveal visual defects and various eye ailments, but it also enables the optometrist to pick

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up physical defects such as diabetes, high and low blood pressure, anemia, and when lucky, the advent of stroke; (2) visual fields study—this instrument is used to determine if there are any constrictions in the normal visual field such as would be experienced in glaucoma, tumors of the eye and brain, stroke, cerebral hemorrhage, degenerative conditions of the retina and many more too numerous to mention, (3) tonometry—this is a very precise instrument in determining if glaucoma is present by measuring the internal pressure of the eye.

Pathology, when found, is then referred to the ophthalmologist, who is an eye physician and surgeon. The ophthalmologist is also qualified to refract. However, his main concern is correcting and treating pathological disorders by means of surgery and/or drugs.

I hope this information has enlightened you on the differences among the three professions.

MRS. R. W. SERA
Largo, Fla.

"Largest" mountain

You state (Sept. '67, p. 90) that Mauna Loa, which rises some 13,680 feet above the sea and some 30,000 feet from the ocean floor to the top, is the world's largest mountain. I was under the impression that Mauna Kea, also in the Hawaiian chain, was the largest.

GENA ROMA
Philadelphia, Pa.

We stated that the question of the largest mountain "can be tricky, because it all depends on what you mean by 'largest.'" Mauna Kea is higher, but in total mass Mauna Loa is much bigger.—Ed.

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Last Meal

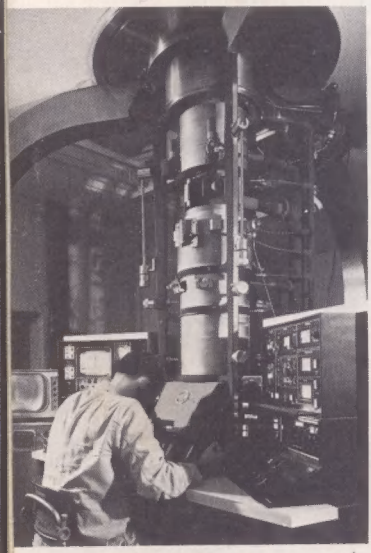
Most feared creature in the waters off the coast of Australia is the great white shark. The above picture shows one of the reasons why. This shark was killed in the act of devouring another shark. Some of the monster's 300, knife-like teeth are exposed. These teeth are sharp and strong enough to cut through flesh and bone like a buzz saw. Most killer sharks circle their prey before attacking, thus giving a skindiver a chance to defend himself or get away. But the great white shark, according to local observers, attacks "like an express train" in a straight-line rush from nowhere at about 30 m.p.h.

In this issue . . .

These giant fruit bats think that their cage is completely dark. But it isn't. They are being fooled by a new technique for displaying animals of the night. Soon you will be able to see zoo creatures you have never seen before. Page 32.

The more we learn about the moon the more earth-like it seems to be. Recent lunar probes show that the lunar "soil" is far more like the soil beneath our feet than we had suspected. You can test yourself on lunar facts on page 76.

That grand pile of rocks known as Stonehenge has fascinated and puzzled men for centuries. But Stonehenge itself is only part of the mystery in that area of England. Page 16.



The most powerful electron microscope ever developed for commercial use is being operated by U. S. Steel to study the structure of metals. Hope is to find stronger, lighter, more durable alloys. This is just one of the developments new for industry this month. Page 66.

The Atomic Age began a quarter century ago. Since that time we have lived in the shadow of the mushroom-shaped cloud. But the age holds promise as well as terror. Isaac Asimov reviews the past and looks at the future. Page 44.

Cape Kennedy is not all rockets and other hardware. For example, there was the woodpecker that kept pecking its way through the cables or the alligator that crawled out on the launch pad. An unusual story begins on page 53.